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New Chart for Figuring Greenhouse Heating

Simplified Method for Determining Heat Losses, Pipe Sizes and Boiler Capacities for Either a Water or Steam Installation

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DETERMINATION of the proper size heating system for a greenhouse is at once a simpler and a more difficult undertaking than a similar determination for any other type of building. It is simpler in that the heat loss, which determines the size of the heating system, may be considered, for all except extremely accurate computations, to occur through the exposed surface alone. This greatly reduces the labor of computations. It is more difficult in that the unit rate of heat loss* cannot be determined with any degree of accuracy, and must be approximated from previous experience

UNCERTAINTY OF HEAT LOSSES THROUGH JOINTS

Loss of heat through the exposed glass surface of a greenhouse is by both radiation and air leakage. The latter occurs partly in poorly-puttied joints, but mostly in the lap of adjacent lights. Its magnitude depends on the number of laps and size of the cracks at these places, upon the natural draft caused by the rising of heated air in the greenhouse, and upon the induced draft caused by the wind. Experimental data exist by which it is possible to closely approximate the effect of the second and third of these factors, but the first is extremely variable and practically indeterminate.

Air leakage also occurs through open ventilators, which again is an indeterminate quantity, but as heating systems are based on severest weather conditions, during which the ventilators presumably will be closed, this source of loss may be neglected. Air leakage, and in great amount, may also occur through broken lights, and as this is most likely to happen during severe storms its effect must be considered and provisions made, through a certain "factor of safety" in the heating system, to counteract it. The amount of this "factor of safety" must be a matter of experience on the part of the greenhouse operator or heating engineer, in which he will be guided by experience in previous storms and by consideration of the value of the greenhouse contents. This feature will be considered again later.

* B.T.U. loss per hour per square foot of exposed surface per degree temperature difference.

FACTORS AFFECTING MAGNITUDE OF HEAT LOSS

The magnitude of the heat loss of a greenhouse depends upon the physical dimensions and quality of construction or condition of the house, and upon the temperature maintained inside and the weather conditions (temperature and wind velocity) outside. Mathematically,

$HL = A\ (t_1 - t_0)\ (k_1 + k_2)$, where

HL = the heat loss per hour,
A = the area of exposed surface,
k_1 = the unit heat loss by radiation, and
k_2 = the unit heat loss by air leakage.

If it is assumed (a) that all air leakage occurs at the lap joints of adjacent lights, (b) that one-half of the joints leak air in and one-half leak air out, (c) that this leakage is proportional to the wind velocity and the width of the cracks at the lapped joints, and (d) that the tests of air leakage around window sashes may be applied to this situation, then

$$k_2 = \frac{w}{w \times l} \times V \times \frac{1}{55}$$

where w = width of a light in feet.
l = length of a light in feet.
V = the leakage of air, per hour, per foot of crack, by test.

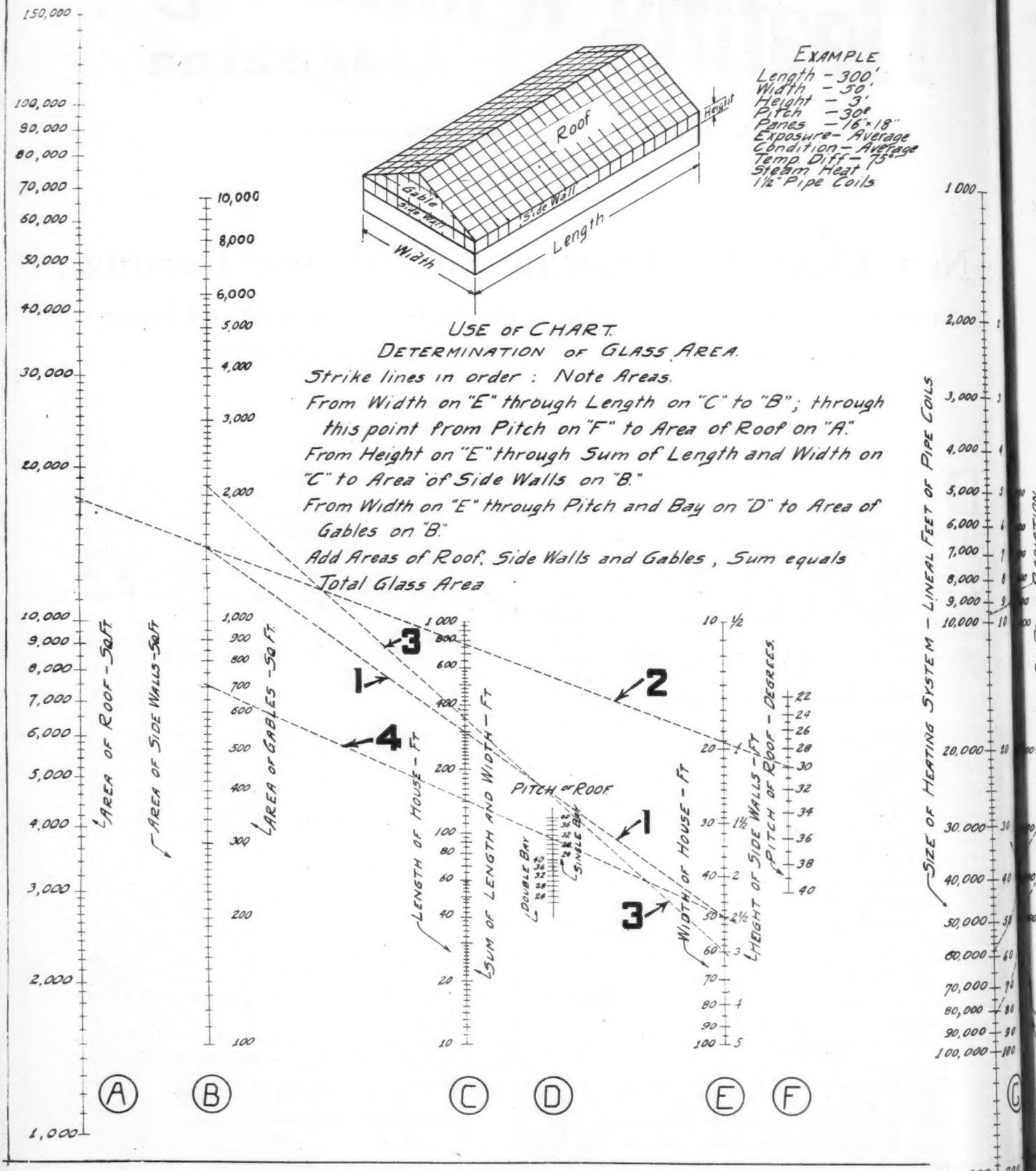
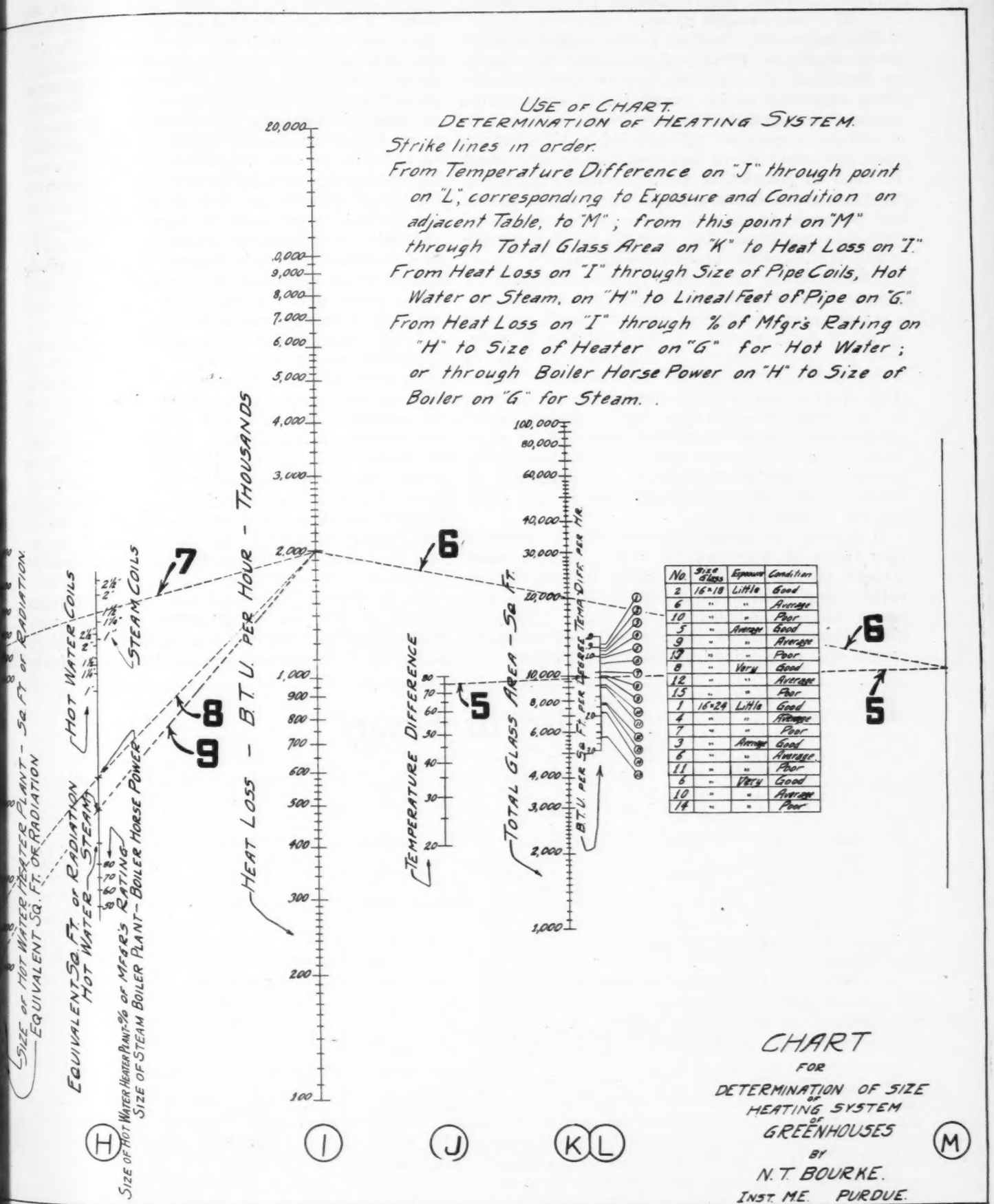

EXAMPLE
Length – 300'
Width – 50'
Height – 3'
Pitch – 30°
Panes – 16"×18"
Exposure – Average
Condition – Average
Temp. Diff – 75°
Steam Heat
1½" Pipe Coils
Roof
Gable Side Wall
Side Wall
Height
Width
Length
USE of CHART.
DETERMINATION of GLASS AREA.
Strike lines in order : Note Areas.
From Width on "E" through Length on "C" to "B"; through this point from Pitch on "F" to Area of Roof on "A."
From Height on "E" through Sum of Length and Width on "C" to Area of Side Walls on "B."
From Width on "E" through Pitch and Bay on "D" to Area of Gables on "B."
Add Areas of Roof, Side Walls and Gables, Sum equals Total Glass Area
AREA of ROOF - SQ FT
AREA of SIDE WALLS - SQ FT
AREA of GABLES - SQ FT
LENGTH of HOUSE - FT
SUM of LENGTH and WIDTH - FT
PITCH of ROOF
DOUBLE BAY
SINGLE BAY
WIDTH of HOUSE - FT
HEIGHT of SIDE WALLS - FT
PITCH of ROOF - DEGREES
SIZE of HEATING SYSTEM - LINEAL FEET of PIPE COILS
A
B
C
D
E
F
G

Chart for Figuring


USE OF CHART.
DETERMINATION OF HEATING SYSTEM.
Strike lines in order.
From Temperature Difference on "J" through point on "L", corresponding to Exposure and Condition on adjacent Table, to "M"; from this point on "M" through Total Glass Area on "K" to Heat Loss on "I."
From Heat Loss on "I" through Size of Pipe Coils, Hot Water or Steam, on "H" to Lineal Feet of Pipe on "G."
From Heat Loss on "I" through % of Mfgr's Rating on "H" to Size of Heater on "G" for Hot Water; or through Boiler Horse Power on "H" to Size of Boiler on "G" for Steam.
HEAT LOSS - B.T.U. PER HOUR - THOUSANDS
TEMPERATURE DIFFERENCE
TOTAL GLASS AREA - Sq. FT.
B.T.U. PER Sq. FT. PER AVERAGE TEMP. DIFF. PER HR.
EQUIVALENT Sq. FT. or RADIATION
HOT WATER
STEAM
HOT WATER COILS
STEAM COILS
SIZE OF HOT WATER HEATER PLANT - Sq. FT. OF RADIATION
EQUIVALENT SQ. FT. OF RADIATION
SIZE OF HOT WATER HEATER PLANT-% OF MFGR'S RATING
SIZE OF STEAM BOILER PLANT - BOILER HORSE POWER
6
7
8
9
5
6
5
No. | Size Glass | Exposure | Condition
2 | 16×18 | Little | Good
6 | " | " | Average
10 | " | " | Poor
5 | " | Average | Good
9 | " | " | Average
13 | " | " | Poor
8 | " | Very | Good
12 | " | " | Average
15 | " | " | Poor
1 | 16×24 | Little | Good
4 | " | " | Average
7 | " | " | Poor
3 | " | Average | Good
6 | " | " | Average
11 | " | " | Poor
6 | " | Very | Good
10 | " | " | Average
14 | " | " | Poor
CHART
FOR
DETERMINATION OF SIZE
HEATING SYSTEM
OF
GREENHOUSES
BY
N. T. BOURKE.
INST. ME. PURDUE.
H
I
J
K
L
M

and $\frac{1}{55}$ = the product of specific heat and specific weight of air.

The value of k_2 depends chiefly upon the width of the cracks at the lapped joints and the velocity of the wind. The former may be more conveniently expressed as the "condition of construction and maintenance" of the greenhouse, and the latter as its "exposure." Expressed in this manner they are more readily grasped, and as they must be used in connection with previous experience, they are more easily applied. It is much easier, for instance, to class a given greenhouse as of "average condition" than to estimate the average width of the cracks between the lights.

The foregoing is the basis of the accompanying chart. A chart solution possesses several advantages over a numerical solution, chiefly in being easier of performance. A chart solution is moreover peculiarly adapted to cases such as this, in which factors of "condition" and "exposure" enter. This chart is correct mathematically on an average to the width of a division line, and will consequently give correct numerical solutions. It may, however, give incorrect practical solutions if an incorrect factor of "condition" or "exposure" is taken. Used with reasonable care it will yield entirely reliable results.

If desired, the numerical value of the combined unit factor of heat loss ($k_1 + k_2$), may be used directly on line "L" of the chart, instead of this value being determined indirectly from the adjacent table of conditions and exposure. However, it is probable that in most cases more accurate results will be obtained by the latter method.

Three conditions of construction and maintenance are given in this table, good, average and poor. A few greenhouses exceptionally well managed and maintained may be classed as "good", the vast majority may be considered "average." No greenhouse, of course, is deliberately designed for a "poor" condition of maintenance. However, the damage done by a severe storm might readily place the best-managed house in this condition, and if it is desired to provide against such contingencies the heating system may be designed for "poor" conditions. For conditions intermediate between "good" and "average," and "average" and "poor," intermediate points on "L" can readily be determined, but it is doubtful if a given greenhouse can be classified more specifically or accurately than good, average, or poor, and such splitting of hairs is not to be recommended.

Three conditions of exposure are likewise given, "little," "average" and "very." A "very" exposed greenhouse is one in the open, in a country location, with nothing to break the sweep of the prevailing storm winds. An "average" exposure is found in the average urban location, moderately protected by nearby buildings from the direct sweep of the wind. By "little" exposed is meant a location almost completely sheltered. Here again values intermediate between the three given may be readily determined if desired, but again also it is not recommended, as wind conditions cannot well be predicted.

In the case of a series of interconnected greenhouses, it must not be forgotten that one house shelters another, and that even in very exposed situations it is impossible for more than one house to

Use of Chart

To Determine	Strike Line	From	On	Through	On	To	On	Read	At Intersection Of	At Intersection On	Remarks
	1	Width	E	Length	C		B				
Total Glass Area	2	Pitch	F	Intersection of 1	B	Area of Roof	A	Area of Roof	2	A	Add. Roof, Side Walls and Gable Areas to Obtain Total Glass Area
	3	Height	E	Sum of length and width	C	Area of Side Walls	B	Area of Side Walls	3	B	
	4	Width	E	Pitch and Bay	D	Area of Gables	B	Area of Gables	4	B	
Heat Loss through Glass	5	Temp. Diff.	J	Unit Heat Loss or Condition and Exposure	L		M				
	6	Intersection of 5	M	Total Glass Area	K	Heat Loss	I	Heat Loss	6	I	
Size of Heating System	7	Heat Loss	I	Diam. Pipe Coils Steam, Hot Water	H	Lin. Ft. of Coils	G	Lin. Ft. of Pipe Coils	7	G	
Size of Steam Boiler Plant	8	Heat Loss	I	Boiler H. P.	H	Size of Boiler Plant	G	Size of Boiler Plant	8	G	
Size of Water Heater	8	Heat Loss	I	Per Cent. Manufacturer's Rating	H	Size of Water Heater	G	Size of Water Heater	8	G	
Equivalent Sq. Ft. of Radiation	9	Heat Loss	I	Eq. Sq. Ft. Rad. Steam or Hot Water	H	Equiv. Sq. Ft. of Rad.	G	Equiv. Sq. Ft. of Rad.	9	G	

be classed as "very" exposed; the others will all be only "average."

USE OF CHART

The determination of the size heating system of a greenhouse divides naturally into three parts: First, the determination from the physical dimensions of the house of the area of the exposed glass surface; second, the determination from the glass area, temperature difference, condition and exposure of the hourly rate of heat loss; third, the determination from the heat loss of the size of the component parts of the heating system.

The chart has been so laid out that its solution falls into three corresponding steps. By reference to the illustrative example worked out on the chart and following in order the successive steps as outlined in the appended table no difficulty should be found in solving any similar condition. The size of the heating elements, hot water or steam, pipe coil or cast-iron radiator, may all be read on line "G" by the use of the proper balance points on line "H." This portion of the chart may also be used for all similar cases regardless of whether it is for a greenhouse heating system or any other. The same is true of the kindred determination of the size boiler or heater plant.

The lineal feet of pipe coil, as thus determined, will not agree with that obtained by the usual rule-of-thumb methods. This is because it is as easy to lay out a chart correctly as incorrectly and as easy to solve, whereas in numerical computations accuracy is frequently sacrificed for ease in solution. The rate of heat transmission of small-diameter pipe coils is greater than that of coils of larger diameter, and this fact has been considered in the construction of the chart.

It is customary in ordinary work to use the same factor of heat transmission for all size pipes, the loss of accuracy being offset by the greater ease of computation. The use of the correct factor will, in most cases, effect a slight saving in amount of pipe required. However, the pipe coils as determined by the chart must conform in installation to the assumed condition of the chart, viz., that a clearance of not less than one pipe diameter must exist between adjacent pipes and between pipes and other objects.

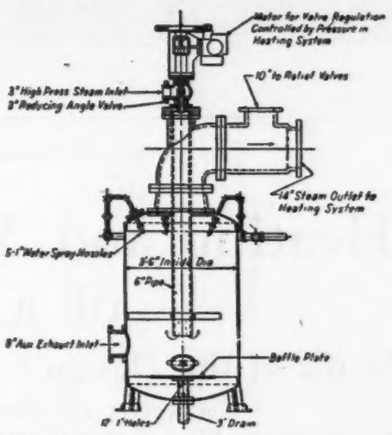
In conclusion, it cannot be stressed too strongly that in the design of a greenhouse heating system, experience is of the greatest importance, and theory must be coordinated with practice if economical designs are to be obtained.

An Unusual Steam-Reducing Valve

In the description of the heating and ventilating equipment for the Weymouth power station of the Edison Electric Illuminating Company of Boston, presented by Davis S. Boyden and A. B. Williams at the recent annual meeting of the American Society of Heating and Ventilating Engineers in Boston, one of the interesting features of the design was a special reducing valve, opening on steam at full boiler pressure and discharging directly into the heating system receiver. The most notable characteristic of this valve is that the steam pressure is reduced in one stage.

As brought out in the description of the plant, the initial heating requirements indicated a maximum demand for 10,000 lbs. of steam per hour. To supply this quantity of steam reduced from 350 lbs. pressure to 10 lbs. pressure and properly desuperheated, together with the necessary nicety of regulation required a reducing valve of unusually excellent characteristics.

The valve used consists of a 3-in. extra-heavy steel-body angle valve. The seat has been replaced by a careful design monel nozzle of the stream-line type. The disc of the valve has been replaced by a combination needle valve and disc. This needle valve in combination with the nozzle provides steam throttling passages of stream line contour, at practically all capacities from zero to maxi-

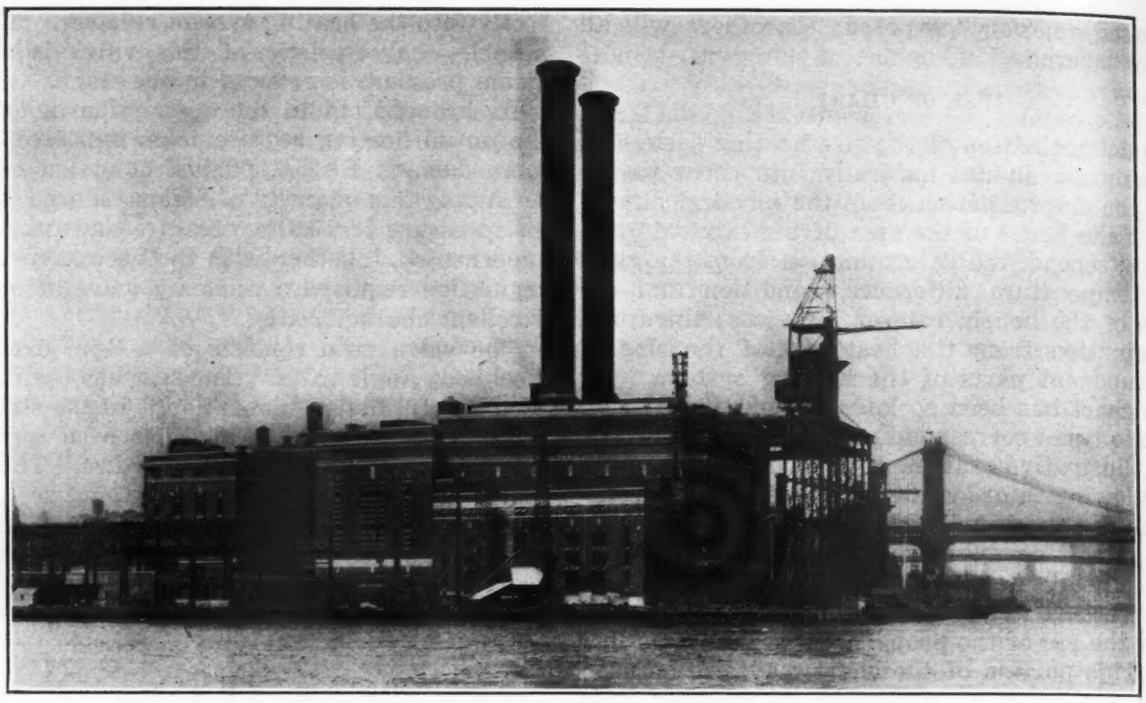

Motor for Valve Regulation Controlled by Pressure in Heating System
10" to Relief Valves
3" High Press Steam Inlet
3" Reducing Angle Valve
14" Steam Outlet to Heating System
5-1" Water Spray Nozzles
3'6" Inside Dia
6" Pipe
8" Aux Exhaust Inlet
Baffle Plate
12 1" Holes
3" Drain

Reducing Valve—De-superheating Tank.

mum flow. A further refinement is that the effective throat of the nozzle is maintained well away from the disc seat so that the valve can operate under severe conditions without erosion due to "wire drawing."

The valve is operated by a motor and reduction gear. This provides an extremely powerful positive motion and effectively prevents any possibility of chattering. The motor is controlled by a reversing relay panel operated by a pressure gage connected to the receiver tank. The gage and control are adjusted so that the valve begins to open when the pressure in the tank drops to 7 lbs. If the pressure continues to drop the valve continues to open in proportion, until it is open wide at 5 lbs. The operator at the switchboard who controls the quantity of exhaust steam, should maintain the pressure in the exhaust header between 7 and 10 pounds.

The reducing valve, therefore, functions when there is not sufficient steam coming from the exhaust system to maintain a minimum of 7 lbs. in the receiver. The receiver tank contains a number of water nozzles which spray the steam as it passes through the tank, thus providing sufficient evaporating effect to destroy the high superheat which would otherwise be present. The low-pressure system is protected from possible excessive pressure by suitable safety or back-pressure valves.



View of Hudson Avenue Station From the East River.

Heating and Ventilating Requirements of a Power Station

Details of the Design for the New Hudson Avenue Generating Station of the Brooklyn Edison Company

By Charles S. Peace

Mechanical Engineer's Department, Brooklyn Edison Company

THE Hudson Avenue Generating Station of the Brooklyn Edison Company is located at Hudson Avenue and the East River, adjacent to the Brooklyn Navy Yard, as shown in Fig. 1, and consists of five buildings, the turbine room, boiler house, service building, switch house and frequency changer building. The ultimate capacity will be over 400,000 K.W. and to date three 50,000 K.W. steam turbine-generators, with their boilers and auxiliary apparatus, have been placed in commission. The present buildings comprise about one-half the complete station and work is now in progress on the extension of the buildings to their ultimate size.

ORDINARY METHODS OF ESTIMATING REQUIRED RADIATION NOT APPLICABLE

Experience at other stations proved that the usual method of estimating the amount of radiation required (by determining the total amount of heat lost through the entire wall, roof, etc., of a room and by the air change) did not give even approximately correct results, when applied to the proportioning of the radiation for large rooms having high ceilings like turbine rooms or boiler houses. Instead, for the large turbine room at Hudson Avenue which is approximately 100 ft. wide and 170 ft. long, with a ceiling height of 80 ft., an arbitrary ceiling was assumed 30 ft. above the floor and the radiation was proportioned to supply the wall and glass heat losses for this 30-ft. strip around the walls. The air change or air infiltration loss was assumed to be taken care of by the heat radiated from the turbines. The radiation for the turbine room was based on maintaining 70° F. inside with 0° F. outside.

In the boiler house a similar 30-ft. ceiling height was assumed and the radiation proportioned to supply the wall losses as in the turbine room. The air change is taken care of by the heat given off by the flues and uptakes of the boilers. The radiation for the turbine room and boiler house basements was calculated to supply the heat losses through the walls and glass. The air filtration loss was assumed to be taken care of by the heat radiated from the various auxiliary units and piping. Radiation was provided to maintain 70° F. inside with 0° F. outside.

UNIQUE FEATURES OF HEATING SYSTEM FOR TURBINE ROOM AND BOILER HOUSE

The design of the heating system of the turbine

room and boiler house presents several unique features not found in the average building design. In a power station there are many sources from which one would naturally expect to derive a large amount of waste heat but from which, in reality, very little heat is derived, due to the very efficient modern methods of insulation. In the Hudson Avenue Station all the heat radiating surfaces have been exceptionally well covered. This, to a great extent, makes the furnishing of the heating for the buildings a matter of a controlled heating system, rather than one of depending on a random radiation of heat from all kinds of uncontrolled sources and tends to carry out the intention of making the heat balance of the station as complete as possible, that is, to account as far as possible for all the heat that is furnished by the combustion of the coal.

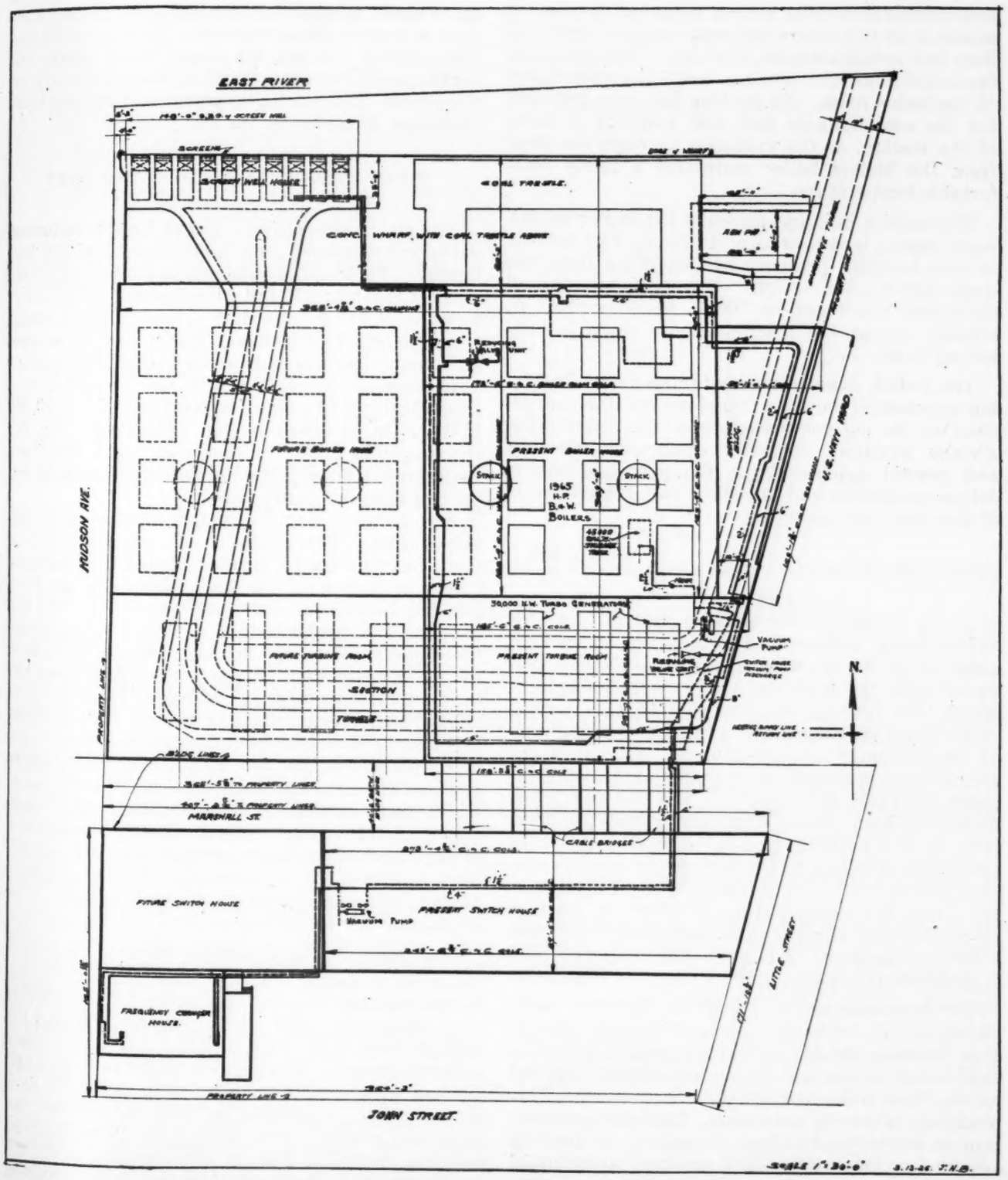


Fig. 1.—General Layout of Station and Heating Mains.

For instance, in the average boiler room enough heat is radiated from the boiler settings to maintain the boiler room at more than a comfortably warm temperature. With the Hudson Avenue boilers, however, despite the high temperature prevailing in the furnaces, the setting of 22½ in. of fire brick, with an enclosing jacket of 3 in. of insulation and ⅛ in. steel plate has such a low heat transmission that the outer surface is hardly more than comfortably warm. This condition exists to a height of about 30 ft. from the boiler-room floor (the setting height of the boilers is about 40 ft.) where the heat radiated from the flues and uptakes begins to be felt. This radiation from the flues and uptakes heats the upper part of the boiler room. No heating has been provided for the coal bunkers and coal handling sections of the station, as the radiation through the floor from the boilers below maintains a fairly comfortable temperature.

The service building contains the locker rooms, wash rooms, laboratories and offices. The heating of this building presents no departure from the usual practice in design. The radiation for all the rooms was based on 70° F. inside with 0° F. outside, except the machine shop which is only heated to 60° F.

The switch house contains the electrical switching apparatus, the auto transformers, the connections to the out-going feeders of the distribution system, auxiliary electrical equipment, starting and control apparatus for the principle motor-driven auxiliaries and the offices and control rooms of the electrical operators.

HEAT GIVEN OFF BY ELECTRICAL APPARATUS A FACTOR

In the design of the heating systems for this switch house, account had to be taken of the heat given off by the electrical apparatus. As this heat varied with the load, the system was designed to supply the heating requirements of the various rooms when the apparatus in the rooms was giving off the minimum amount of heat. Several of the rooms were heated by by-passing or drawing off warm air from other parts of the building. The design of both the heating and ventilating systems of this building had to be worked out with particular attention to the prevention of condensation of moisture on high-tension electrical apparatus since this condensation is likely to produce grounding and short circuit conditions with their attending dangers. Radiation has been provided to maintain the rooms at 70° F. with 0° F. outside.

The frequency changer building houses a large 35,000 K.V.A. frequency changer set which acts as a tie between the 25-cycle system supplied by the Gold Street station and the 60-cycle system supplied by the Hudson Avenue and 66th St. stations. This machine, when in operation, furnishes enough heat to warm the building; therefore, the heating system for this building was designed to maintain the temperature at about 50° F. with 0° F. outside when the machine is shut down.

REASONS FOR SELECTION OF VACUUM HEATING SYSTEM

In general the heat losses to be supplied by the heating system were those through the walls of the buildings, and this in combination with the excellent steam supply available, made a steam system with direct radiation around the walls best suited to the case. A vacuum system was installed as being more efficient, giving more positive circulation, requiring smaller pipe lines and as being more easily adapted to the conditions at the station than a gravity return system. In layout, the system serving the turbine room, boiler house and service building consists of a loop header around the walls under the basement ceiling of these buildings, as indicated on Fig. 1.

STEAM PRESSURE REDUCED IN TWO STEPS

The steam supply is furnished by two reducing-valve units connected on opposite sides of the loop header. These units take steam from a saturated steam header at 250 lbs. pressure and reduce it to 5 lbs. with 80° F. superheat. Low-pressure steam from the steam-driven auxiliaries cannot be used as in many installations because all of the auxiliary apparatus of the station, with the exception of a single boiler-feed pump for every set of two 50,000 K.W. units, is motor-driven. The feed water for the station is heated by means of steam bled from the main turbines after having been partially expanded and done work there.

Fig. 2 shows a typical detail of these reducing-valve units. The reduction, it will be noted, is made in two steps by means of two Leslie reducing valves in each unit, the first valve reducing from 250 lbs. to 125 lbs. and the second from 125 lbs. to 5 lbs. This double reduction was adopted because the reduction from 250 lbs. to 5 lbs. was considered too much to make with one valve. A by-pass has been provided around each reducing valve and gate valves have been provided to cut the reducing valve out if it should fail. The globe valves in the by-passes in conjunction with the pressure gages are used for hand operation by throttling the steam in the event of a reducing valve going out of commission. The relief valves shown protect the system against excessive pressures.

ARRANGEMENT OF RETURN LINES

The condensation is collected by a return system following in general the steam mains. In the boiler house and turbine room basements this return line runs around the walls and at several locations lift fittings have been used to allow the line to pass under doorways. The location of the radiators and the long return main made a continuous pitch back to the pump impossible so that, in general, the main was pitched down toward the corners of the building where lift fittings were installed to lift the condensate to such an elevation that it would again pitch back toward the pump. A Nash Engineering

Company Type B duplex vacuum pump unit serves the turbine room, boiler house and service building and discharges the condensate into one of the station's 45,000 gal. water storage tanks located in the boiler room basement.

The switch house is supplied by a low-pressure main carried across a bridge over Marshall Street. A low-pressure main was used in preference to carrying a high-pressure line into the switch house, with a reducing valve unit, as it was not deemed advisable to have high-pressure steam in such close proximity to the high-tension apparatus. The system in general is of the up-feed type and the condensate from the switch house and frequency changer building is pumped by a second Nash Type B duplex vacuum pump, located in the switch house basement, over the bridge to the storage tank. The steam supply and return lines to the frequency changer building are carried underground through an insulated conduit from the switch house. A unit heater using Aerofin heaters and a disk fan has been installed in the cold air corridor of the switch house to dry the ventilating air supplied to the electrical switch rooms. This unit is designed to heat 8100 cu. ft. of air per minute from 20° F. to 120° F.

STEAM TO HOT WATER STORAGE TANKS SUPPLIED FROM HEATING MAINS

The heating mains also furnish steam to two thermostatically-controlled hot water storage tank heaters which supply the hot water used in the wash rooms, one serving the switch house and the other the service building, and to coils in the roof tanks of the boiler house and switch house to prevent the water from freezing. Provision has been made to waste the condensate from these hot water tanks during the period the heating system is shut down so that the vacuum pumps will not have to be operated to handle the small amount of condensate from these heaters.

HOW PERFORMANCE OF HEATING SYSTEM IS CHECKED

An interesting feature of the design is the arrangement made to check the performance of the heating system. Steam-flow meters have been installed in the high-pressure supply lines to the reducing-valve units to measure the steam consumed by the system and a meter has been placed in the return line to measure the condensate returned to the storage tank. With these meters a continuous check can be made upon the steam consumption and the efficiency of the system.

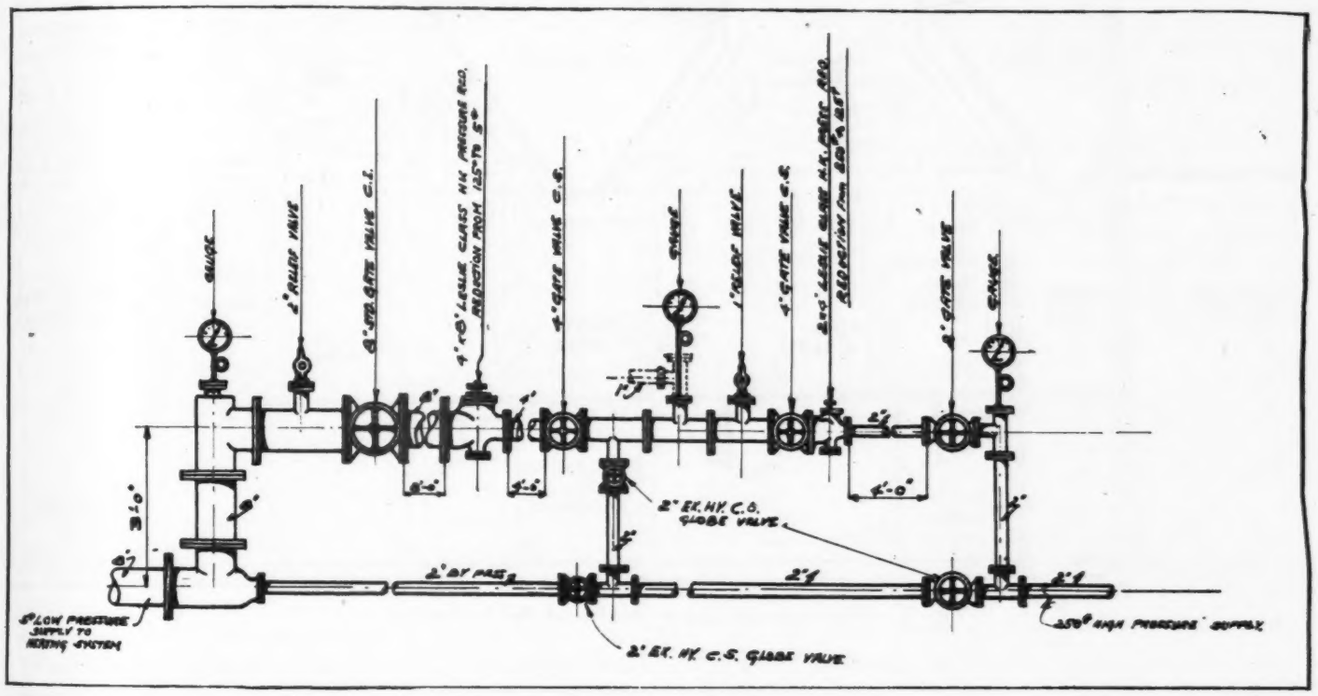

GAUGE
2" RELIEF VALVE
3" STR. GATE VALVE C.I.
4"x3" LEADLE CLASS HH PRESSURE RED. REDUCTION FROM 125 TO 5#
4" GATE VALVE C.S.
STRAINER
1" RELIEF VALVE
4" GATE VALVE C.S.
3"x2" LEADLE GLOBE H.S. STEEL RED. REDUCTION FROM 200 TO 125#
4" GATE VALVE
STRAINER
2" EX. HY. C.S. GLOBE VALVE
2" BY PASS
2" EX. HY. C.S. GLOBE VALVE

Fig. 2.—Detail of Reducing Valve Assembly.

RADIATION INSTALLED IN VARIOUS BUILDINGS

The accompanying tabulation gives an idea of the amounts of radiation installed in the various buildings.

	Equiv. Sq. Ft. radiation	Lbs. Steam per hour.
SWITCH HOUSE		
Direct radiation	4958	
Hot water tank	173	
Unit heater	2000	
Roof tank	44	
Total	7175	2152
FREQUENCY CHANGER BLDG.		
Direct radiation	928	278

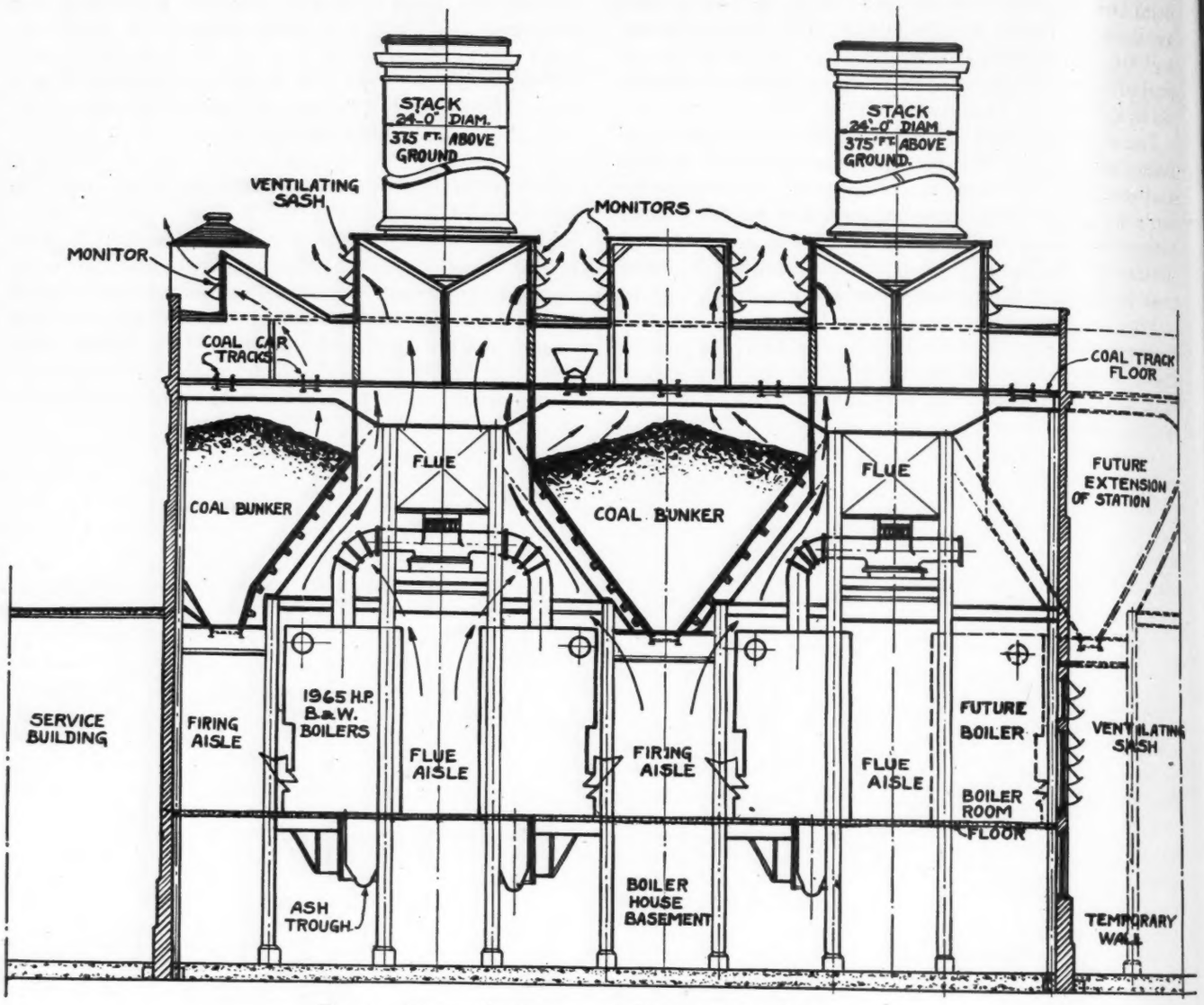


Fig. 3.—Diagrammatic Cross Section of Boiler House.

SERVICE BUILDING		
Direct radiation	3554	
Hot water tank	350	
Total	3904	1171
BOILER HOUSE		
Direct radiation		
Basement	1071	
Operating floor	3339	
Roof tanks		
10,000 gal. house service	28	
10,500 gal. fire service	29	
TURBINE ROOM		
Direct radiation		
Basement	1106	
Operating floor	945	
Total	6518	1955
Grand total	18,525	5556

Webster vacuum traps, radiator valves and lift fittings and American Radiator Company Peerless wall and legless column radiators have been used throughout the system.

In general, the coefficients of heat transmission for the various materials given in the Warren Webster & Company's book "Steam Heating" were used in the design and their method of calculating the air infiltration per linear foot of perimeter of sash and doors was used in preference to any assumption of air change per hour for the room. The pipe sizes have been proportioned for a 1-lb. pressure drop at the most remote radiator.

VENTILATION PROBLEM ONE OF CARRYING OFF HEATED AIR AND GASES

In central station design the problem of ventilation is largely one of dissipating or carrying off heated air to prevent uncomfortable or dangerous temperaures in the working spaces or apparatus compartments except, perhaps, in the boiler room where, in addition, the ventilating system may be designed to carry off gases leaking from the boilers or flues.

In the Hudson Avenue Station natural ventilation has been used wherever possible as being more dependable, cheaper to operate and having a lower maintenance cost than any system of arti-

ficial ventilation. Of course, due to the small force available to move the air, larger ducts were needed and the first cost of installation of such system is probably larger than the cost of installing an artificial system.

Large monitors have been provided in the boiler house roof to allow the escape of the heated air and gases collecting in the upper parts of the building and large areas of ventilating sash have been installed to supply the necessary fresh air. Separate monitors have been provided above each coal bunker and each flue aisle.

Fig. 3 shows how the sloping sides of the coal bunkers, which run practically the entire width of the boiler house over the boilers, act as vent hoods which tend to collect the heated air and gases and discharge them through the monitors.

Ventilation has been provided for the turbine room by a large monitor running the length of the room directly over the main turbine generators. Air is admitted through ventilating sash in the windows. The sash of all these monitors are operated by motor drives.

CLOSED CIRCUIT COOLING SYSTEM PROVIDED FOR EACH GENERATOR

The ventilating system installed on each of the main units to dissipate the heat produced by the electrical losses in the generators is of interest. The usual method of ventilating large generators consists of passing air through the windings by means of fans built into the rotor, or by an external blower, and discharging this air into the turbine room. The air is usually drawn directly from the room or from outdoors and in many cases air washers or filters are used to extract the dust.

This method of cooling has several fundamental disadvantages. The air even when passed through air washers carries dust which is deposited on the windings of the generator forming an insulating blanket which prevents the dissipation of the heat and necessitates frequent cleaning to prevent dangerous temperatures in the machine. The large amount of air supplied will, in the event of a short circuit in the generator, fan the fire and seriously damage the machine before it can be stopped. At Hudson Avenue a closed circuit cooling system is provided for each machine, that is, the air after passing through the machines is passed through air coolers and returned to the machine again. This insures clean air being supplied and eliminates the expensive shutting down of the unit for cleaning. The air is contained in an air-tight duct system so that in the event of a fire in the machine the oxygen in this small amount of air will be used up and the fire will smother itself. The air coolers consist of a large number of tubes through which cold water is circulated. These tubes are provided with fins similar to those used on auto truck radiators to increase their cooling surface. The water used is drawn from two wells located behind the switch house, well water being used to reduce as far as possible the necessity of cleaning the tubes which would have been necessary with East River water. Fresh city water was not used on account of the expense involved.

SUBDIVISION OF SWITCH-HOUSE VENTILATION IN KEEPING WITH ISOLATION OF VARIOUS ELECTRICAL UNITS

The switch house presents the most striking feature of this natural ventilation design. Here three separate natural ventilating systems have been provided to furnish air to cool the various units, the first to serve the auto transformers located at A, Fig. 4; the second, the apparatus on the machinery floor B; and the third, the reactors in the switch rooms C.

The subdivision of the switch house ventilating system is in keeping with the general electrical design which called for the isolation of the various electrical units as much as possible by partitions and walls to prevent trouble on one unit being transmitted to the others and causing a general failure.

The auto transformers, of which each generator has three, are in separate compartments, each group of three being served by a single ventilating stack of about 100 sq. ft. cross sectional area and 90 ft. effective height. The air passes in from the street around the transformers and up the stack.

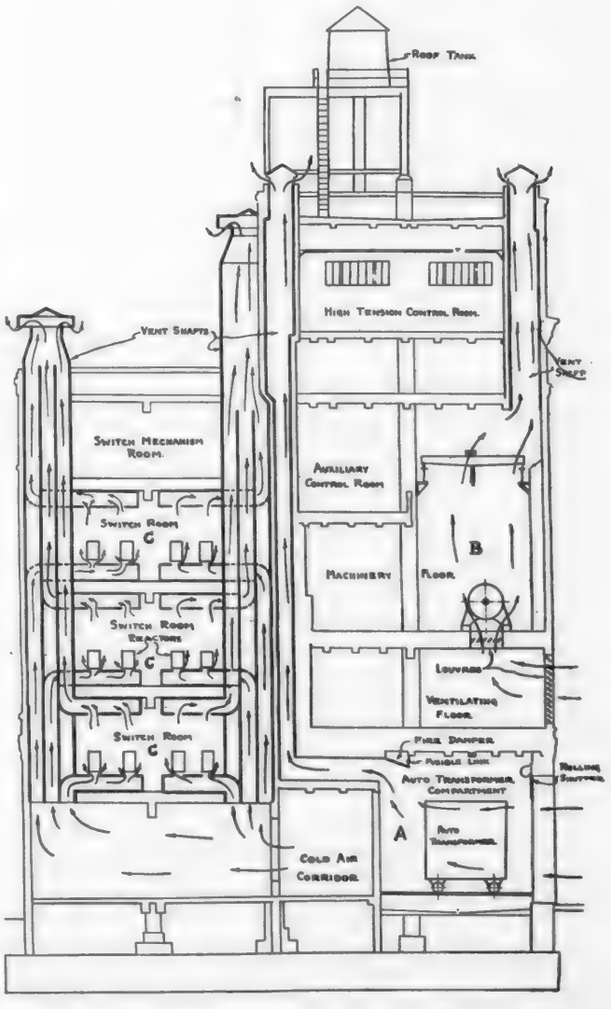


Fig. 4.—Diagrammatic Cross Section of Switch House.

The maximum safe temperature of the air in the transformer compartments is limited to 115° F. so that with the outside air at 90° F. in summer only a 25° F. difference in temperature is available to produce the motive head to move the air up the stack. The stacks are designed for this summer condition and are lined with steel plate and every precaution has been taken to reduce the friction losses as much as possible.

In winter, when a greater temperature difference is available, the rolling shutters at the intake to the compartments are partially closed to throttle the air supply and to prevent a large volume of cold air passing up the stack and chilling the building. Fire dampers have been provided in the outlets and inlets of the compartments with fusible links arranged to close the dampers automatically in case of a fire in the compartment and so to cut off the air supply.

On the machinery floor B are located motor generator sets, frequency changer sets and other auxiliary apparatus which are cooled by air passing in from the outdoors through the ventilating floor and up through openings in the machine bases and escaping through vent shafts to the roof. Louvres are provided to shut off or throttle the air supply in winter.

MEASURES TAKEN IN VENTILATING SWITCH ROOMS TO PREVENT FLAMES AND SMOKE FROM PASSING FROM ONE TO ANOTHER

The switch rooms C are supplied with air from the cold-air corridor. It is interesting to note how the air is drawn off the vent shaft and returned to the same shaft after cooling the reactors by a duct above them and how one shaft has been provided for each of the three switch rooms to prevent the flame and smoke passing from one to the other through the ventilating ducts in the event of an electrical fire in any one of the rooms. Each generator has a set of three switch rooms each of which are ventilated by two shafts as shown on Fig 4. In designing the ventilating system for these switch rooms particular attention had to be given to the possibility of having moisture condense on the switches and other high-tension apparatus when damp weather suddenly succeeds a period of cold. Moisture in the air and condensation on the apparatus is dangerous in that leakage of the high-tension current and, in extreme cases, breakdown results. This danger has been overcome by providing radiators in the cold-air corridor and by a unit heater located near the air intake to heat a portion of the air to about 120° F.

OPERATING DATA ON PERFORMANCE OF VENT STACKS

The following resume of some temperature and air measurements give an idea of the performance of the vent stacks serving the auto transformers.

Volume of air circulated through all three compartments, cubic feet per minute	30,600
Inlet temperature, deg. F.	44
Average outlet air temperature, deg. F.	57.5
Average velocity of air in the stack, feet per minute	312

The stack area was calculated by using the ordinary chimney formula.

In the frequency changer building a large ventilating space is provided under the machine to which air is admitted from outdoors by an air shaft about 10 ft. square. The air is drawn from this ventilating space by fans which are built integral with the rotor of the machine. The machine, which is of 35,000 K.V.A. capacity, consists of a 25-cycle, motor directly coupled to a 60-cycle motor and arranged so either can be used as a motor to drive the other as a generator depending upon whether the operating conditions require a delivery of 25-cycle or 60-cycle current. Each of these motors is totally enclosed in an air-tight housing and air passages have been provided through the windings and the structure of the motors to allow the cooling air drawn in by the fans to circulate. The heated air is discharged at the top of the motors and escapes through a large monitor in the roof of the building. The heat given off by the machine when in operation averages about 2000 K.W. or 6,800,000 B.T.U. per hour. Some conception of the size of this unit may be gained from the fact that the stator frames of the motors are about 20 ft. in diameter and the unit weighs well over 1,000,000 lbs. A separate system of ventilation is provided to cool the field rheostats of the motors which are located in the basement of the building.

What We Don't Know About Flow of Water in Pipes

We have only a rough general knowledge of the resistance to flow of water and steam in the practical kind of pipe that we commonly use, and little or none relating to the various kinds of valves and fittings. The theoretical laws of the flow of water through perfectly smooth pipes have received an enormous amount of attention from all sorts of investigators, but we cannot get perfectly smooth pipes for our work. One important branch of our ignorance is in relation to the degree of variation which we find in the resistance of pipes of commercial quality, and the amount of friction-head lost in passing practical bends and different kinds of fittings.

For accurate calculations we require to know the resistance to flow of water or steam in passing through a complete radiator, including inlet and outlet junctions and valves. The resistance of the various kinds of valves is indeed almost unknown.

In future I think we shall have to bring pressure to bear on the makers of pipes, fittings, and valves to provide us, not only with quotations, but also with a guarantee of their resistance so that we may be in a position to calculate our flows with some accuracy.—A. H. BARKER, *before the (British) Institution of Heating and Ventilating Engineers.*

This is the seventh lesson of

The Heating and Ventilating Magazine's

New Home-Study Course in Gravity Steam and Water Heating

Lesson No. 7

WHILE data by which the size of mains for gravity water heating-systems were given in Tables H-1-3 and H-1-4, included with the preceding lesson, it is not necessarily correct to assume that a main having a given area will supply a stated amount of radiation regardless of the number of units into which the radiation is divided and without regard to the positions of the radiators.

There are two governing factors—volume of water circulated and the velocity of flow. The volume circulated is influenced materially by the cross-sectional area of the pipe, while the internal frictional resistance of the inner surface of the pipe may have a decided effect upon velocity.

When the radiation is divided into many units, the frictional resistance is greater than when the radiation units are few. The velocity of flow is reduced because of the necessary use of more fittings, and a greater number of bends in and additional length of piping. The rate at which heat is emitted from a radiator is governed by the temperature of the water in the radiator and the velocity at which the water circulates through the radiator.

The sizes of mains when established by the use of tables, such as Tables H-1-3 and H-1-4, should be reduced or increased as rapidly as the changes in radiation will permit and the lengths of all mains to any point should be measured back to the boiler. Risers to any floor in the case of an up-feed system should be proportioned to supply all the radiation above that floor, as well as the radiators installed on the particular floor. In the case of a down-feed system, the riser should be reduced as branches to radiators are taken off.

Work Problem H-2-1

The note at bottom of Table H-1-3, with reference to reduced capacity of mains that are longer than 100 ft., states that the reduction should be in the ratio of $\sqrt{\frac{100}{L}}$. This is applied as follows:

Consider a 3-in. main supplying direct radiation—by the table, this size main if not longer than 100 ft. will supply 675 sq. ft. of radiation. If the main is assumed as 150 ft. long, the reduced capacity is found as follows:

First: Divide 100 by the actual length of main.

$100 \div 150 = 0.6667$

Second: Take square root of result First.

Square root of $0.6667 = 0.83$

Third: Multiply radiation value from table for the proper size main by result Second and obtain a value for the reduced capacity.

$675 \times 0.83 = 550$ sq. ft.

Work Problem H-2-2

PIPE SIZING FOR AVERAGE RESIDENTIAL PLANTS

While it should be kept in mind that conditions of installation must always be given consideration when planning a gravity water heating system, yet, for average residential work a much-used method, and one which is simple to apply, is to determine pipe sizes by the combined area of valves supplied. When this method is used, the area of the main supply as it leaves the boiler should exceed the combined area of all valve connections to all radiators.

It is therefore proper that each student should be able to size a main using valve areas. This method is not essentially different from that presented in the preceding lesson in connection with Tables H-1-1 and H-1-2.

Valve or pipe areas in square inches for sizes from ½-in. to 3-in. diameter are contained in Table H-2-1. In using this table it must be assumed that pipe capacity varies only as the area which, while not entirely correct, permits the use of a simple means of pipe sizing with fair assurance of reasonably accurate results.

Fig. H-2-1 shows a section of a supply and a return main of an up-feed two-pipe gravity water heating system the piping for which is to be sized by using valve areas. The radiators on the three floors have areas as follows:

Radiator	A	B	C	D	E	F
Sq. Ft.	48	56	50	40	70	48

Using Table H-1-5, the size of all risers are obtained as follows:

Radiator	A	B	C	D	E	F
Riser Size, in. diam.	3/4	1	1	3/4	1 1/4	1

Using Table H-2-1, the size of the supply main is determined by beginning at the last radiator served as B and working back to the boiler. The last section of the main as U preferably should be made one or two pipe sizes larger than the last riser served in this example—section U will be made a 1½-in. pipe. By Table H-2-1, the area of a 1½-in. pipe is 1.76 sq. in. The area of the riser supplying radiator D is 0.44 sq. in. which, added to the area of U equals $1.76 + 0.44 = 2.20$ sq. in., indicating that section V should be 2 in. in diameter. Similarly, the sizes of W, X, Y and Z are found to be: $W = 2.20\ (V) + 0.78\ (F) = 2.98$ re-

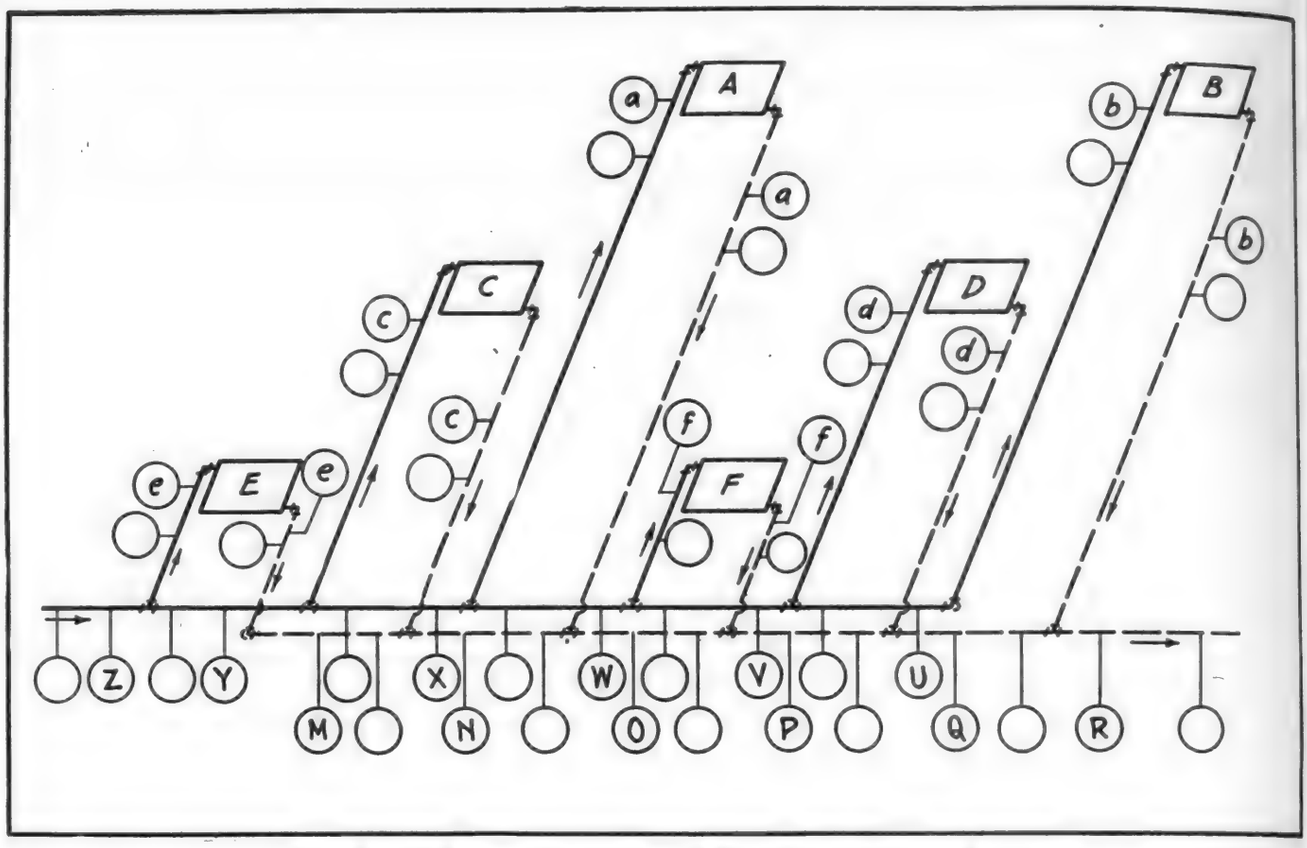


Fig. H-2-1. Reversed Return Run of Piping for Six Water Radiators.

quiring a 2-in. pipe $X = 2.98\ (W) + 0.44\ (A) = 3.42$ requiring a 2½-in. pipe; $Y = 3.42\ (X) + 0.78\ (C) = 4.20$ requiring a 2½-in. pipe; $Z = 4.20\ (Y) + 1.22\ (E) = 5.42$ requiring a 3-in. pipe.

The return main is sized by starting at radiator E and determining the areas required to provide increased capacity as other risers enter the return main. The values thus obtained are:

M = two sizes larger than riser to E=3.14 requiring a 2-in. pipe
N = 3.14 (M) + 0.78 (C) = 3.92....requiring a 2½-in. pipe
O = 3.92 (N) + 0.44 (A) = 4.36....requiring a 2½-in. pipe
P = 4.36 (O) + 0.78 (F) = 5.14....requiring a 3 -in. pipe
Q = 5.14 (P) + 0.44 (D) = 5.58....requiring a 3 -in. pipe
R = 5.58 (Q) + 0.78 (B) = 6.36....requiring a 3 -in. pipe

Tabulating all sizes of pipe thus obtained for the runs of Fig. H-2-1, the following table results.

Radiators		Supply Main		Return Main	
Letter	Supply & Return Pipe Size, In. Diam	Section Pipe	Size, In. Diam.	Section Pipe	Size, In. Dia
A	¾	U	1½	M	2
B	1	V	2	N	2½
C	1	W	2	O	2½
D	¾	X	2½	P	3
E	1¼	Y	2½	Q	3
F	1	Z	3	R	3

Work Problem H-2-3

A starting pipe, as shown in Fig. H-1-9, is often installed between the flow and return main at the boiler in an up-feed system. This pipe may vary in size from 1¼ in. to 2½ in. diameter, depending upon the capacity of the boiler, and is used to assist in the establishment of an initial circulation between flow and return mains before the water in the mains is in full movement.

It is considered good practice for both open and closed-type gravity water heating systems to end the supply main at the connection to a first-floor radiator and to make this connection with a reducing elbow immediately under the vertical upright to the valve, but this may not always be possible. When carried to a first-floor radiator supply riser, the last section of main preferably should be made two pipe sizes larger than the radiator connection, but when the last radiator supplied is on the second floor, one pipe size larger may be ample. However, it is believed advisable generally to carry this last section of a main two pipe sizes larger than the last radiator served and then control the circulation by means of a suitable valve. But no hard or fast rule should be adopted for all cases. Experience and judgment must enter into the consideration of every design.

Generally, branches to radiators should be made equal in size to the upright connection to the radiator valve. If the branch is of exceptional or unusual length, or if it supplies a riser as well as a first-floor radiator, it should be proportioned to carry the additional load or to compensate for the unusual length.

The position or location of the radiator which is to be supplied has much to do with the method of connecting the branch to the main or in the vernacular of the trade "taking off the branch connection."

PIPING DETAILS AND CONNECTIONS

Nothing is more important in designing and installing a gravity water heating system than the method of making branch connections for both supply and return.

Water is a good conveyer of heat. It is also a poor conductor of heat for molecules of water do not quickly give up heat to one another but require a continuous circulation and mixture. Consequently, circulation in a water heating system is of utmost importance for hot water, at the heater, is of no particular use unless the piping is installed so that it will circulate to and from the cooling or radiating surfaces.

Rapidity of circulation means (1) higher average temperature maintained in the radiating surfaces, (2) smaller pipe and radiator sizes due to increased rate of transmission and (3) reduced losses in conveyance because of the smaller pipe sizes. It is equally important that circulation be uniform. These requirements demand a system proportioned throughout as to sizes of mains and branches so that each radiator may receive the proper quantity of circulating water without robbing some other radiator near or far from it.

Proportioning of mains and branches has been touched upon in this and the preceding lesson. It should be realized though and particularly by those who are only beginning the study of gravity water heating systems that a properly-proportioned system might be designed only to fail miserably in operation because branch and other pipe connections were not correctly installed.

The manner of making pipe connections should be very carefully considered by the designer and the design should show by enlarged details or other appropriate manner the relative positions of different fittings used at branch, supply and return points. No other feature of gravity water heating design requires more experienced judgment or contributes more liberally to satisfactory and efficient operation.

The warmest water in a pipe travels along the upper part of the pipe. Therefore if all branch connections to a main were taken off the top, the result would be a short-circuiting of some radiators, with those nearest the boiler receiving the warmest water and the others in varying degree depending upon their distance from the boiler. It is also poor practice to take a branch from another branch. Better control and circulation is assured by going back to the main for each group of radiators so that the piping system is balanced by each supply serving nearly equal amounts of radiation.

In all systems, the tendency is for the warmest water to seek the highest radiators. This requires that means be employed to control the flow to induce a better circulation in the lower radiators. First-floor radiators should often be favored by separate connections from the mains and, in general, the size of long mains should be reduced only slightly since this will offset the disadvantage of added friction and cooling due to the greater distance from the end of the main to the heater. A liberal and ample size of main assists towards an even distribution of the water throughout the system. Frequent reductions are the cause of sluggishness and short-circuiting.

By introducing additional resistance at the point where the tendency to circulate in one direction may interfere with a necessary circulation in another direction, a good circulation may be assured in the less favored direction. Means of control

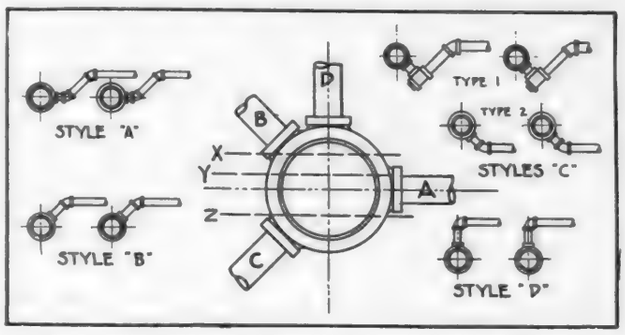


Fig. H-2-2. Styles of Branch Connections to Mains.

may be by special fittings, special pipe connections or by special valves.

BRANCH CONNECTIONS TO MAINS

Four styles of branch connections to mains are shown in Fig. H-2-2, noted as styles "A," "B," "C" and "D." Two types of style "C" connection are shown.

Style "A" connection is used for making a branch connection to the main when the branch is to supply a first-floor radiator or a first-floor radiator and a riser. This connection should generally be used only at points where no reduction occurs in the size of the main.

Work Problem H-2-4

Style "B" connection is used for making a branch connection to the main when the size of the main is reduced where the branch is taken off, otherwise air might collect in the pocket formed at the point of reduction. Air pockets interfere seriously with circulation. Style "B" connection permits any air that might collect at such a point of reduction to pass into the branch pipe, thence into the radiator from which it may be exhausted through the air valve on the radiator.

When the design consists of a principal main with several branch mains, a style "B" connection should generally be used where each branch leaves the principal main.

Work Problems H-2-5, H-2-6

Style "C" connection has a very important position in piping design of gravity water heating systems. In this type of heating system there is always a tendency of the heated water to seek the highest point of the system so that it is quite essential at times to install branch connections for risers

that supply radiators on upper floors that reduce this tendency. The use of this style "C" connection under such conditions generally will prevent short-circuiting and any tendency of the flow from an upper-floor radiator blocking off circulation in the main return beyond the point of the connected branch. The more a tee is turned downwards, the more the circulation through the side outlet is retarded. Thus a style "C" connection prevents a branch from "robbing" the circulation to the radiators connected at a greater distance from the boiler.

"Robbing" of circulation is often the condition that spells failure in the operation of many gravity water heating systems by preventing an even distribution of the circulating water and causing what is termed an "unbalancing" of the system.

If the first branches taken off the main get an excessive amount of hot water, there is sure to be a weakening of the circulation in the main as the distance from the boiler is increased. In every installed job, there is a slight difference in the temperature of the water at the top from that at the bottom of the pipe and for this reason, a connection to a first-floor radiator located quite near the boiler often should be made so as to retard the flow through it. Style "C" branch connection frequently offers the proper solution.

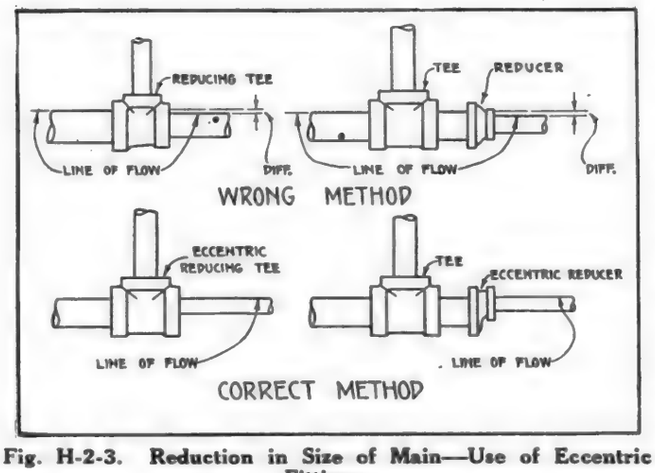


Fig. H-2-3. Reduction in Size of Main—Use of Eccentric Fittings.

Type 1 of style "C" should be used only for radiators which do not require venting as in the case of down-feed systems or for basement radiation where the radiators are located below the main, the air being vented from upper radiators or, if this be down-feed, from the high point of the system.

Work Problems H-2-7, H-2-8

Style "D" connection has a definite place in gravity water heating piping design but must be used with extreme caution. This connection is applicable for branches that supply radiators that must be favored. If used near the boiler especially for an upper-floor radiator, it will almost always cause undesirable circulation with the result that the particular radiator thus served will be excessively hot while others are relatively cold. The designer should be very careful in specifying this style connection.

Too much importance cannot be attached to the necessity of using a proper style of branch connection. The turning of a tee up or down often may spell success or failure.

The sketch accompanying styles of branch connections in Fig. H-2-2 illustrates the effect of placing the outlet of the tee in several different positions. If the top connection (style "D") or the 45° connection (style "B") is used, either will appropriate the circulation down to the dotted line marked X. With the tee outlet turned directly horizontal (style "A"), the branch will appropriate the circulation only up as high as indicated by the dotted line Y. In the case of a tee turned downwards 45° (style "C") the level of branch flow from the main is reduced to that of the dotted line Z.

REDUCTION IN SIZE OF MAIN

When a main or branch is reduced in diameter, an eccentric fitting should be used so as to avoid an air pocket and keep the bottom of the inside surface of the main or branch in line. Eccentric tees and eccentric reducers serve this purpose as indicated in Fig. H-2-3 where the right and wrong methods are illustrated. The use of eccentric tees prevents lodging places for water and assures a more even flow along the main than where double-reducing fittings are used such as a straight reducing tee and an eccentric bushing connected with a close nipple. If a reduction in a main is required and an eccentric tee is not available, it is better to use full size on the run and an eccentric reducer as this assures full capacity and an even flow line to the reducer.

When ordering or inquiring concerning eccentric tees, it is advisable to submit a sketch showing the exact position in which the fitting is to be placed and the eccentric openings. In specifying the size of a tee, give the diameter of outlet openings by stating the run-openings first followed by the side outlet diameter.

Work Problem H-2-9

RADIATOR CONNECTIONS AND RISERS

Various details should be observed in making connections to radiators and the manner in which run-outs from the same riser to two radiators of equal area on the same or on different floors is always deserving of serious consideration. A number of connection and fitting details are shown in Fig. H-2-4 and will be explained by the assigned detail number and referred to in subsequent lessons.

Detail 1 (Fig. H-2-4) shows a method of connecting radiators when piped as for a one-pipe gravity water heating system. The radiator connections are usually made top and bottom, with a straightway quick-opening water radiator valve

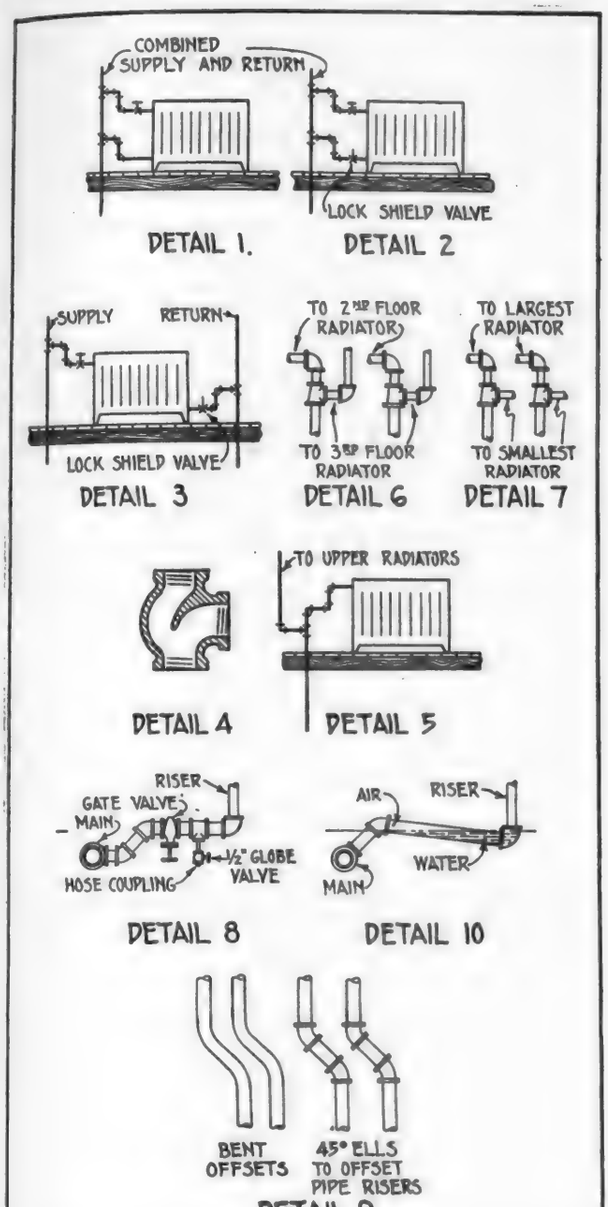


Fig. H-2-4. Piping Details and Connections, Details Nos. 1 to 10.

with union placed as shown. This type of valve can be fully opened or closed by one-quarter turn of the handle. It must be connected so that the current of water will move in the direction indicated by the arrow on its side. This valve may be obtained in stock sizes of ¾-in. to 2-in. diameter. Water radiator valves of this type are provided with a hole in the disc which allows for slight circulation when the valve is closed. If a steam type of radiator valve is used for gravity hot water service, it should have a small hole through the bridge wall.

Work Problem H-2-10

Detail 2 (Fig. H-2-4) shows the same connections as detail 1 with a control valve placed on the return connection to radiator. This valve on the return line should be a valve fitted with lock and shield. If the vertical pipe is made the same size above, below and between points A and B, there is danger of the flow being shunted past the radiator so that the radiator is liable to get too little, rather than too much, water. The proportioning of pipes for such a run as shown will be covered in a succeeding lesson.

Work Problem H-2-11

Detail 3 (Fig. H-2-4) shows a water radiator with double-riser connections. A straightway (or angle) quick-opening water radiator valve with union is installed on the supply side and a key-operated valve on the return side. While the use of two such valves necessarily increases the cost of the installation yet there is perhaps little doubt that of all methods of controlling circulation in a gravity water heating job, the most satisfactory and reliable method is by the use of special control valves. Furthermore, when the extra cost of special fittings and the extra time involved in making special connections are taken into consideration, it is not unlikely that to install a control valve is very nearly as cheap as any other method of control.

The results secured with control valves are generally considered superior. The valves may be set at any desired opening or left entirely open if the circulation is satisfactory. With a radiator controlled as indicated in Detail 3 and with all piping installed with proper pitch so that air pockets are eliminated, a positive control of circulation is almost assured. By commencing at the hottest radiators and gradually closing the return valve until the resistance to flow through it is just sufficient to induce the proper circulation in all the other radiators, the system can be regulated so as to operate at uniform temperature. After the entire system has once been adjusted, the return valves can be set permanently and the radiators controlled by means of the supply valves.

Work Problem H-2-12

Detail 4 (Fig. H-2-4) shows a special fitting called an O. S. distributor. This fitting assists towards insuring positive, uniform circulation of hot water. The deflector lip prevents the establishment of a full flow of the hot water to the upper floors and assures a more even distribution to all radiators on the line. The use of this fitting may often result in a considerable saving in time, labor and fittings. It is obtainable in a great variety of sizes ranging from ½ to 2½ in.

Work Problem H-2-13

Detail 5 (Fig. H-2-4) shows pipe connections that produce practically the same result as the special O. S. fitting. The hot water rises straight to the top of the pipe where there is only one path open for it, namely, into the radiator. The supply for other radiators on floors above is taken from

the side of the riser somewhat below the connection to the lowest radiator. Connections of this kind are repeated at each of the lower radiator connections but need not be used on the upper levels as these radiators do not require favoring.

Detail 6 (Fig. H-2-4) shows the kinds of fittings to be used for piping like Detail 5. The importance of making connections in this manner is generally realized since hot water rises more readily to upper floors and always seeks the path of least resistance. Thus, the second-floor radiator is favored by being connected from the top of the tee and the more active flow to the third floor radiator is restricted by the fact that the riser is connected into the side.

Work Problem H-2-14

Detail 7 (Fig. H-2-4) shows a method of supplying two radiators of unequal size located on the same level and connected to the same riser. The larger radiator should be supplied from the top of the tee and the smaller from the side thereof. These connections will favor the radiator to which the circulation will be more active, since a greater volume of water is required for the larger radiator if both radiators are to heat evenly.

If two radiators of the same size and located on the same level are supplied by the same riser, the circulation may be equalized by reducing the size of the top connection.

Work Problem H-2-15

Detail 8 (Fig. H-2-4) shows how run-outs to radiators or branch arms may be equipped with a gate valve for entirely closing off the supply in case this may be desirable and with a globe valve and hose connection, in order that the water may be drawn off from the piping when repairs are needed or to guard against freezing when not in use. The gate valve should be installed with the handle looking down and the globe valve as shown.

Work Problem H-2-16

Valves and elbows and other fittings introduce additional frictional resistance within the flow lines. In gravity water heating systems where the motive head is small, this may be a serious factor, especially in the smaller pipe runs in which frictional resistance is comparatively much higher than for the larger sizes of pipes. In some cases it may be found advantageous to limit the use of elbows by bending the smaller sizes of pipes where offsets are required as indicated by detail 9 (Fig. H-2-4).

Detail 10 (Fig. H-2-4) illustrates the necessity of pitching the branch properly. As illustrated, the air is pocketed, circulation is practically stopped and no means exists by which the air may be removed. Such condition should be avoided.

APPLICATION OF PIPING DETAILS

In Fig. H-2-5, three details are shown, each of which consists of radiators that are to be piped. Detail 1 (Fig. H-2-5) shows two radiators of un-

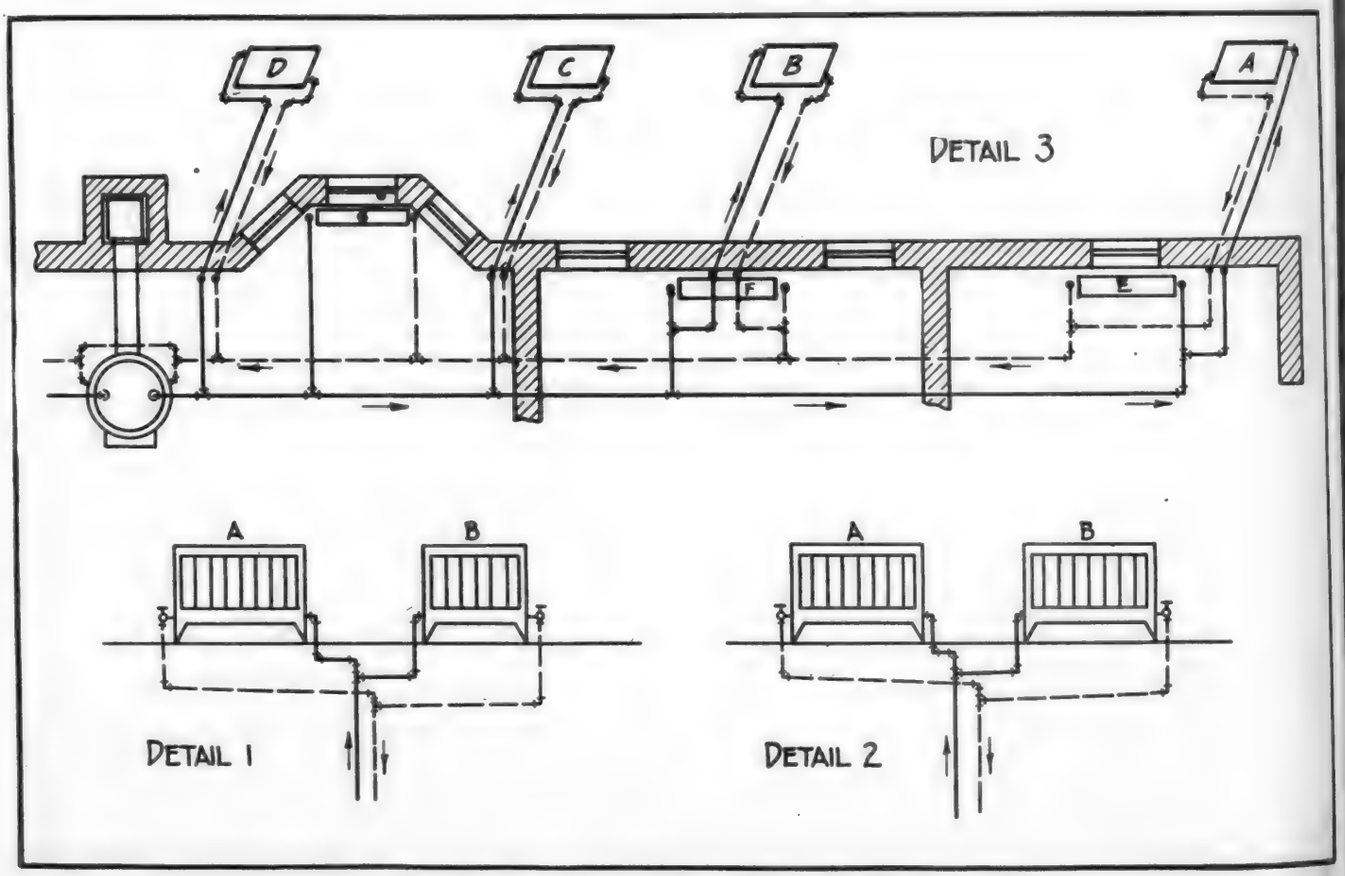


Fig. H-2-5. Application of Piping Details and Connections.

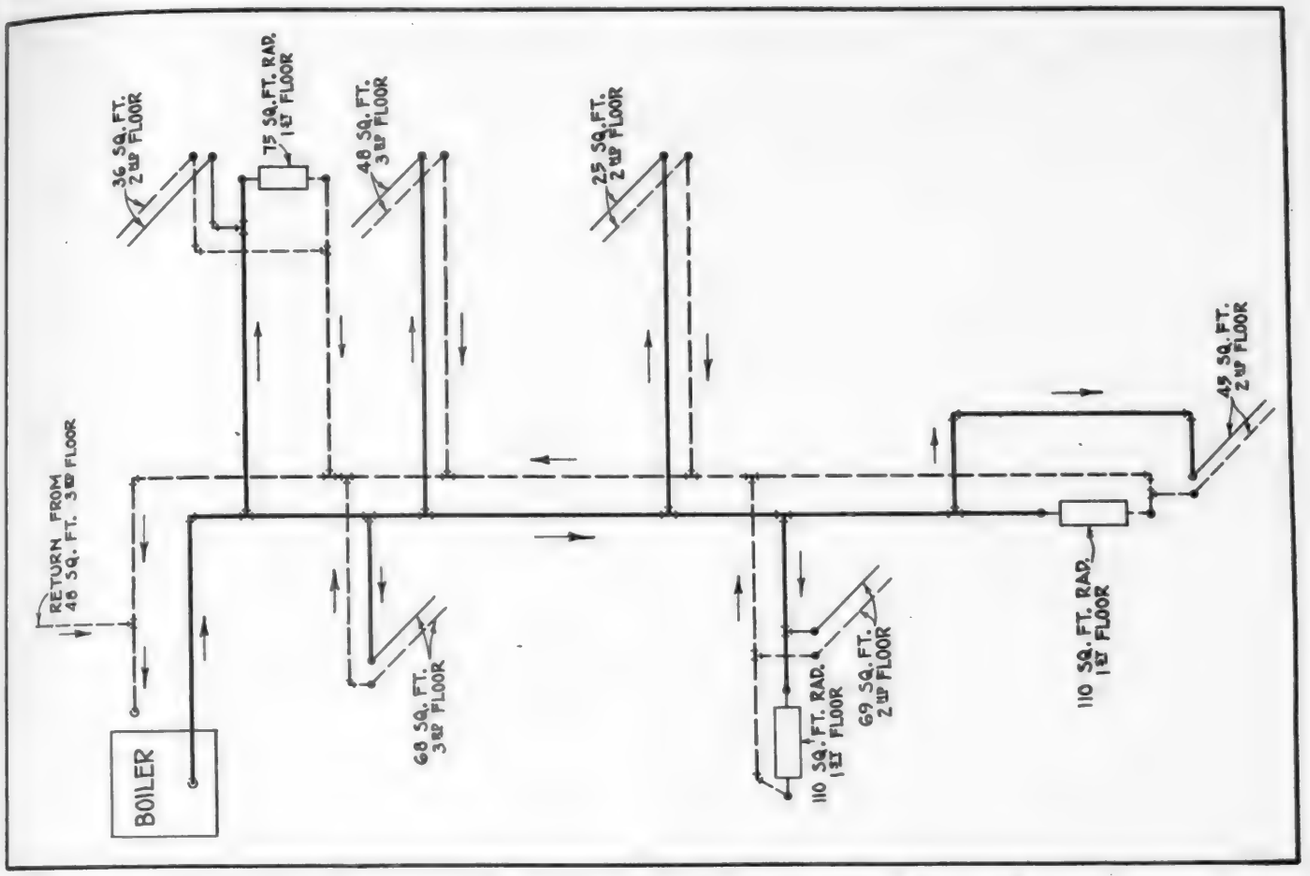

36 SQ. FT. 2ND FLOOR
75 SQ. FT. RAD. 1ST FLOOR
48 SQ. FT. 3RD FLOOR
25 SQ. FT. 2ND FLOOR
49 SQ. FT. 2ND FLOOR
RETURN FROM 48 SQ. FT. 3RD FLOOR
68 SQ. FT. 3RD FLOOR
110 SQ. FT. RAD. 1ST FLOOR
69 SQ. FT. 2ND FLOOR
110 SQ. FT. RAD. 1ST FLOOR
BOILER

Fig. H-2-6. Arrangement of Piping for a Two-Pipe Up-Feed Water Heating System.

Instruction in this course is available only to subscribers of The Heating and Ventilating Magazine. The first lesson appeared in the November, 1924 issue. However, students can commence the course at any time. Immediately upon receipt of your enrollment, Lesson 1 will be sent to you, together with the Work Problems pertaining to Lesson 1. Full directions will be included as to where to send your solutions of the Work Problems.

The complete course consists of not less than 30 lessons. The first five lessons are devoted to the fundamentals of heating and ventilation. The second section, commencing with Lesson 6, is devoted to gravity water heating. This will be followed in due course by sections on radiators and radiation, gravity steam heating, steam and water boilers and cost estimating.

The cost of the complete course, including a critical analysis of the Work Problems as solved by each student, is $80.00, payable in equal monthly installments of $10.00. An enrollment blank will be sent you upon request, together with full directions for securing all the benefits of the course.

Students who satisfactorily complete the course will be awarded a Graduation Certificate which will correspond in value to the character of the lessons themselves.

equal size located on the same level; Detail 2 (Fig. H-2-5) shows two radiators of equal size located on the same level; and Detail 3 (Fig. H-2-5) shows a main leaving a boiler, the main is to supply seven radiators aggregating 410 sq. ft. of direct radiation, with three radiators on the first floor and four on the second.

TABLE H-2-1
EQUIVALENT VALVE AREAS

VALVE OR CIRCLE DIAM. INCHES	AREA SQ. INS.
½	0.20
¾	0.44
1	0.78
1¼	1.22
1½	1.76
2	3.14
2½	4.90
3	7.06
3½	9.62
4	12.56
4½	15.90
5	19.63
6	28.27
8	50.26
10	78.54

Work Problems H-2-17, H-2-18, H-2-19

In Fig. H-2-6 there is shown a piping run for a two-pipe up-feed water heating system. It is desired that this layout be supplied as an installation print having all sizes marked thereon; also that the style of every connection from the main be specified.

Work Problem H-2-20

The third lesson of the water-heating section, to appear next month, will include a study of the one-pipe up-feed system, the down-feed two-pipe system with single riser and the down-feed two-pipe system with double riser.

Test on Steam Heating Requirements of Sleeping Cars

By H. A. Woodworth

THE following data were obtained from a test conducted by H. A. Woodworth, consulting engineer, of St. Louis, Mo., on an average-type of Pullman sleeping car located in the layover yards of the Pullman Company. The car was standing isolated and was supplied with live steam at about 20 lbs. pressure from the underground steam mains which extend from the Pullman Company's power house.

The car is heated by being supplied with 524 ft. of 1½-in. pipe (259 sq. ft. of radiation), the coils running the length of the car. The coils all have a common return to a drip trap located under the car. A size B Detroit condensation meter was fastened on the outlet of the trap.

The following items were taken into consideration:

Steam pressure supplied to the coils in the car.
Inside temperature of the car.
Temperature of air outside the car.

Meter readings of condensed steam as wasted from the coils to the ground beneath the car. The figures for these items were as follows:

Average steam pressure carried on the car during the test, 18.5 lbs.
Average outdoor temperature, 28.59° F.
Inside average temperature of car, 79.9° F.
Pounds of steam per car hour, 80.5 lbs.
Condensation per square foot of installed radiation per hour, 0.311 lbs.

The results indicate that 805 lbs. of steam per car-hour are somewhat lower than those obtained in similar tests at 30° F., which were made by the C. M. & St. P. R. R. a few years ago. However, a very loose connection of the coupling to the underground main was used. This allowed the steam to blow considerably and removed the line condensation which would otherwise have gone into the car and have been measured. This represents about 10% of the car condensation.

Our result is 80.5 lbs., as compared to 85 lbs. per car-hour.

Following is a copy of the test conducted by the C. M. & St. P. R. R.:

Outside Temperature Deg. F.	Inside Temperature Deg. F.	Condensation per Car-Hour, Pounds
40	70	70
30	70	85
10	70	100

The average local temperature during the eight months of the heating season (in St. Louis) is 43° F. Allowing for line loss, our results check very closely with the figures given above. Taking these figures for our basis of computation, we would figure the condensation as 65.5 lbs. per car-hour as an average during the season. The number of cars, multiplied by the number of hours that the steam is used, gives the amount of steam used to heat the Pullman cars. The foregoing, it is felt, is correct and very conservative.

Following are the test data:

TEST DATA ON PULLMAN SLEEPING CAR.

Time	Temperature Outdoors Deg. F.	Temperature Inside Car, Deg. F.	Steam Pressure at Reducing Valve, Pounds	Steam Condensed per Hour, Pounds	Steam Condensed per Square Foot of Radiation per Hour, Pounds
10 A.M.	26.6	82.4	16.4	100	0.386
11 A.M.	27.7	80	24	100	0.386
12 A.M.	28	79	19.5	100	0.386
1 P.M.	29.5	79	18	57.1	0.221
2 P.M.	29.5	79	17.7	59.4	0.229
3 P.M.	30.25	80	15.4	66.6	0.257
Average	28.59	79.9	18.5	80.5	0.311

Note—Eight ventilators 6 in. x 3 ft. were open in roof during test.

These results indicate 80.5 lbs. of steam per car per hour at 28.59° F. outside temperature, with an average temperature of 79.90° F. inside the car.

Known and Unknown Factors in Heating Work

The whole field of heating and ventilation may be broadly divided into two parts: the first relates to the working properties of the materials and plant employed, such as building materials, radiators, boilers, pipes, fittings, fans, air ducts, and the like. The second, which is much more difficult, relates to the results produced by the plant.

One may say that many of the most obvious parts of the first section, which were uncharted ten years ago, have since been partly explored. I refer particularly to the heat losses through the best-known heavy building materials and some of the lighter structures which we and others have examined. We have also obtained a fairly complete survey of the gross total emission of heat from radiators in standard conditions. This is now being supplemented by investigations of emission of radiators placed in different conditions than the standard one—of the effect of different paints and coverings, and, above all, by a very complete analysis of the emission between radiation and convection. The latter research has a bearing of enormous importance on the second half of the field and has hardly been commenced.—A. H. BARKER, before *the (British) Institution of Heating and Ventilating Engineers.*

District Steam Heating in Small Communities and Residential Districts

How to Make a Survey for a Centralized Heating System and What Data Should be Included for the Design of Such a Plant

By *Walter J. Kline*

(From a paper presented at a joint meeting of the Cleveland Engineering Society and Cleveland Chapters of the A.S.M.E. and A.S.H. & V.E. in Cleveland, January 13, 1925).

FIRST of all, the climate of the particular locality, and the monthly temperatures, which are the principal factors, as well as the relative humidity and wind movement, must be taken into account. According to U. S. Government weather bureau records over a long period of time, average mean temperature in Cleveland, October to May, inclusive, is 39.7° F., while the yearly mean average is 49° F. The monthly "means" are as follows:

October	52.8° F.
November ...	40.2°
December ...	30.9°
January	26.7°
February	26.8°
March	34.5°
April	45.8°
May	57.9°

Weighted Average, 39.7° F. for 8 months—243 days, or 5,832 hours.

The amount of heat required depends, of course, upon the factors just mentioned, as well as the character of building construction, and to a large extent on the character of occupancy. This diversity of occupancy is one of the items which contributed materially to the advantage of the district or central boiler plant when compared with the individual efforts of a large number of separate buildings. In this latitude during the eight months heating season (243 days or 5,832 hours), the monthly percentage of consumption is about 5% of the season total in the warm months, and about 20% in the coldest months, as shown by the following table of approximate division of season heating requirements:

October	5% of season
November	10%
December	15%
January	20%
February	20%
March	15%
April	10%
May	5%
	100%

DISTRICT AND LOAD

With a specific district or community for consideration, the first item to be determined is the potential "load" or "maximum hourly" and "season" steam demands. Various methods may be employed to complete a census of the "square foot of radiation" installed or required by each building, or to estimate the cubic contents of each building, from which the necessary radiation may be computed and condensation factors applied.

SEASON AND MAXIMUM DEMANDS

Where known condensation factors per 1000 cu. ft. of space are available, they can be applied direct to the estimated "cubic contents" to thus ascertain the annual steam requirements of the district. With these same data of radiation or cubic space, known factors of "maximum hourly steam demand" can be applied. From the total maximum hourly pounds of steam, thus determined, provision for the proper amount of boiler capacity can be made. Furthermore, these calculations of maximum steam requirements are a necessary basis for calculating the sizes of pipes in the steam distribution system.

BOILER PLANT DESIGN AND LOCATION

Having determined the maximum hourly demand for steam, the problem consists of, first, the design of a suitable boiler plant for the service, and the selection of a proper location with reference to all the factors involved, particularly with reference to delivery of fuel, gravity returns where advisable, etc., and secondly, the design of the steam distribution system.

Questions of boiler plant design have been well standardized in these later years, and great advance made in the apparatus for economical production of steam. This is the heart of the district heating problem, but scarcely more important than efficient distribution and efficient metering.

The answer, or "cost per 1000 lbs. of steam," must contain not alone the cost of fuel, resulting from the combined efficiency of boiler and furnace, but also all items of boiler maintenance, fixed charges, and depreciation on the cost of the necessary boiler equipment, and underground distribution system.

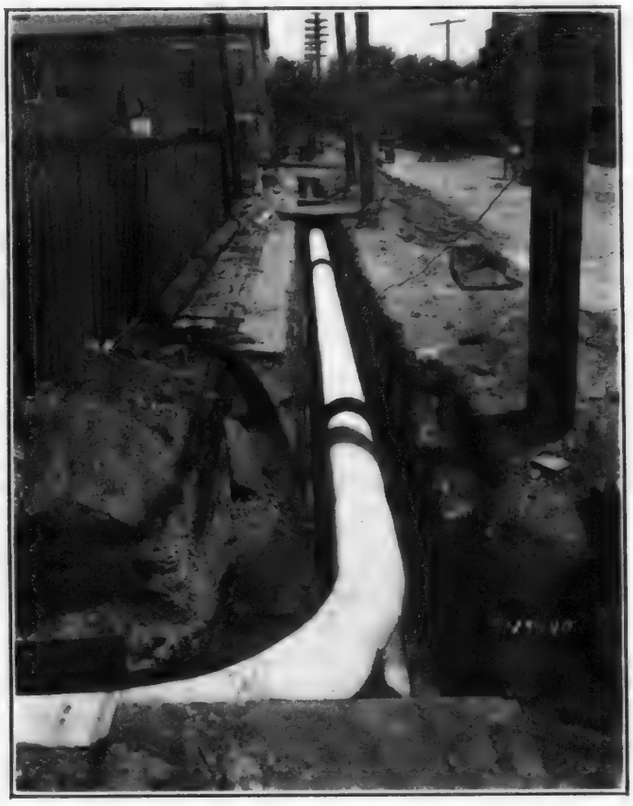
Make the most steam for the least money, and *insure continuity of service* is a good goal for which to strive, in the engineering consideration of design and selection of boiler plants for district or central heating operations.

STEAM GENERATING PRESSURE—SYSTEM PRESSURE CONTROL

Present boiler practice for district steam heating service is to generate steam at high pressures and maintain a uniform pressure in the boiler drums. From the drums, steam is discharged through pressure reducing valves into the distribution system.

It is good practice to carry only the initial pressure in the distribution system necessary to give service at terminals of the system.

The necessary regulation through the station reducing valve is the duty of the plant engineer, assisted by long-distance electric gauges, which show him constantly the pressure at control points —terminals. By maintaining a minimum pressure predetermined, service at other points is certain. By eliminating excess pressures on the system,



Pipe Line Run Under Sidewalk in Dayton, O.

Construction of Inside and Outside Forms for Pipe Conduits

Multicell Type of Conduit Construction Ready for Back Filling

12-in. Pipe Line Laid Across Canal 30 ft. Wide

Examples of Underground Pipe Conduit Construction.

losses are kept at a minimum. This method of pressure control is adapted to both low and high-pressure system.

DISTRIBUTION SYSTEMS

Distribution systems may generally be divided into two classes—low-pressure and high-pressure. Low-pressure systems are those generally considered at initial pressure of 5 to 10 lbs. with possible slight increases in coldest weather, while high-pressure systems are those which are operated at pressures considerably higher, up to 100 lbs. gauge or more. Low-pressure systems are generally those in which a considerable proportion of exhaust steam is used, while the higher-pressure systems supply live steam for process work, in addition to heating.

DESIGN AND CONSTRUCTION

The design and construction of the distribution system follows after the conditions of local service have been determined. The character of the construction in any case must be suitable for the conditions and of such nature that the result will be long life and low transmission losses. Construction of this character also results in low physical maintenance, which is a very important consideration. *Depreciation* of well-constructed systems should be calculated on the basis of at least a *30-year useful life.*

INSULATION

Insulation consists of (a) the quality of kiln-dried wood stave casing, which, if used on low-pressure steam mains, also serves in the dual capacity of conduit, or in other types (b), the application of 85% magnesia, air cell or sponge-felted coverings, waterproofed, and surrounded by a protecting conduit of multicell tile, concrete, brick, or vitrified tile. The enclosing conduit may be constructed so as to appreciably augment the insulation.

Underdrainage is an important detail to be watched, while traps for removal of condensate from mains cannot be omitted. Street traps should be connected to condensation meters, to measure and record transmission losses or condensate. These losses in well-constructed systems should average less than 5% of the total steam passing through the system, while an average of better than 85% of output will be registered in the "customers' meters" of carefully-operated systems. This method of expressing overall operating efficiency should not be confused with the conventional method of comparing percent of heat saved by pipe insulation, compared to heat loss of bare pipe under same conditions.

RETURN MAINS

An item of importance for consideration is that of returning condensate to the boiler plant. The determining factors are the value of the return water and the fuel value of the heat contained therein, plus whatever value is assigned to the effect (of the pure water) on the operating economy of the boilers. The topography of the district has an important bearing on return systems. Where necessary to operate pump because of grades, the cost and additional investment reduces the apparent saving.

The solution to this problem is to design the necessary return system and determine the cost and fixed charges. The saving in heat, water, and boiler efficiency must then at least equal or exceed these fixed charges before the construction of the return system is justified. In the majority of cases of extensive district heating systems, water is of good quality, price reasonable, and since customers' equipment should utilize heat in the condensate to fullest extent, it should not reach the return system at a temperature higher than 100° F. In these circumstances, the heat saving will not exceed 50 B.T.U. per pound of condensate. Therefore, the resultant fuel saving is small, and the total saving insufficient to warrant the additional investment.

BUILDING PIPING AND EQUIPMENT

The equipment of buildings to take service from a district plant need not differ in any particular except as to external source of supply instead of the individual plant. It is true, however, that the constant supply available from a district system results in more satisfactory heating, with the same piping and radiation.

Needless to say, buildings should be equipped with the very best system of piping and radiation, susceptible of economical use of steam without waste. This is possible by means of pressure-reducing valves, thermostats, etc., as well as by reason of the inherent economy of the design of the system.

METERS

Metering of district heating service is very largely by condensation meter except where high-pressure steam is distributed for power and process purposes as well as heating, in which case steam flow meters are employed. For example, in a report by the National District Heating Association, 43 member companies reporting aggregate nearly 1300 condensation meters and less than 200 steam flow meters.

GENERATING COSTS

Generating cost of steam under modern conditions is mainly dependent upon the item of fuel cost and efficiency of combustion. In some localities a supply of fuel-oil is abundant, and where the cost is "in line" with that of bituminous or anthracite coal, the saving in labor makes oil-burning desirable. In a large majority of existing district heating plants, however, coal is burned either by underfeed stokers or the still more modern method

of powdered coal, where plants are of sufficient size to justify the installation. This because of cost, availability, etc.

DISTRIBUTION

Direct cost of steam distribution consists of the maintenance of the metering system, reading of meters, etc., inspection of apparatus in customers' building, equipment, and the inspection of street condensation traps and meters. Also where the slip type of expansion joint is used, periodic inspection and tightening of gland bolts is necessary. This latter expense is eliminated when the closed or packless type of expansion joint can be used.

OFFICE AND COMMERCIAL

Office and commercial costs include solicitation, clerk hire for billing, postage, etc. Ample allowance for superintendence and operating engineering is recognized as an essential item for proper results in any operation. The amount is in general proportion to the responsibilities.

The sum of the foreging items of *operation* plus the item of *depreciation* becomes the *total direct operating cost.* To arrive at the "total cost of the service" there must be added "fixed charges on the investment" and a reasonable operating profit: otherwise capital will not be attracted to undertake the duties attendant upon management and development.

The total of the operating costs and fixed charges plus profit, divided by the total number of pounds of condensate required to heat the district, given the *average price per 1000 lbs.* at which steam must be sold.

RATES

The unit basis of selling steam for heating, etc., is 1000 lbs. condensed and measured by condensation meter, or 1000 lbs. measured by steam flow meter.

The form of district steam heating rates is usually that of a descending scale of unit prices and and ascending scale of pounds used. This serves the purpose of equalizing monthly bills, since costs of production are necessarily higher in the warm months when volume is low, than in the cold months when volume of production and demands are greater. Usually provision is also made for a minimum monthly charge, based on size of connected heating load. In some cases the rate takes the form of a "demand" charge based upon the size of building, and is sufficient to cover all fixed charges, plus a "condensation charge" sufficient to cover operating costs.

What existing rates for district heating service are to-day in various cities of the United States will be found in the bulletins published by the National District Heating Association. These rates necessarily vary according to the cost of fuel and other items in the particular localities. Where boiler fuel is approximately $5.00 per net ton, the average rate for heating service is about $1.10 per 1000 lbs. Due to severe fluctuations of fuel costs, during conditions of the past few years, nearly all heating rates now contain "coal clauses," whereby any variations of coal cost are automatically compensated, usually an adjustment of 1c. for each 10c. per ton variation, up or down from the established base.

COMMUNITY HEATING

The subject on which this discussion is based was the application of "District Steam Heating to Small Communities and Residential Sections." The application to small communities is perfectly feasible from a mechanical standpoint of construction and operation, and the advantages and benefits accruing from such installations can be readily determined in each case. Many of the present district heating companies supply steam to residential sections, as well as to business districts, and the result of this combination is a very excellent heating "load factor," due to the long hours of use by residences.

COST OF HEATING

A question frequently asked is concerning the comparative cost of heating from district or central plant service, compared with cost of individual "self service." Steam can be generated at efficiencies well over 80% with low-priced fuel in large boiler plants with good load factors. It is equally true that the small individual house boiler, with its small load factor and no diversity, cannot hope to sustain an operating efficiency of more than 35% or 40% at the best with fuel at higher costs. It is apparent that this difference in efficiency of fuel combustion, as well as the cost per ton, offers the opportunity for the district plant to supply *heat units* at a less cost than that at which the individual can produce them. This "differential" is large, and with advantage of low transmission losses of well-constructed distribution systems, the service can be sold on a basis advantageous to both consumer and the utility.

In a district heating plant in this latitude where accurate records have been kept of the quantity of steam required for heating a large number of residences, the *average* results are approximately as follows for *four* successive heating seasons:

Number of houses	133
Average volume per house	19,200 cu. ft.
Average radiation per house	320 sq. ft.
Average steam per season	633 lbs. per sq. ft.
Average steam per house per season	200,000 lbs.

From the foregoing you will note that at $1.20 per 1000 lbs., the average cost per house in the above case is $240.00 per annum, or about $1.00 per day average. This is a very moderate cost, considering the size of the dwellings and the service enjoyed. These houses are all of the detached type, partly brick and partly frame structures.

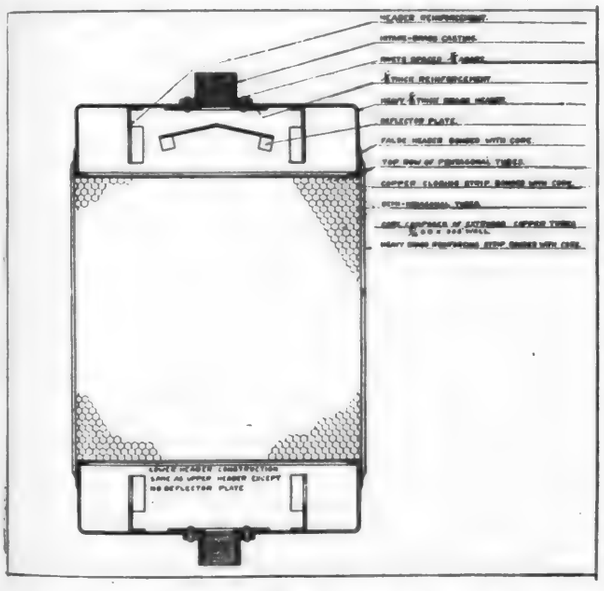
Characteristics of an Air-Tube Copper Heater

By L. J. Bousquet and G. A. Foisy

(Abstracted from a paper presented at the Annual Meeting of the American Society of Heating and Ventilating Engineers in Boston, January 28-30, 1925).

AN AIR-TUBE cellular type of indirect heater (known as the Cartridge copper heater) the characteristics of which are presented in condensed form in this article differs radically from any other heaters at present used in indirect work already described in these columns (see THE HEATING AND VENTILATING MAGAZINE for November, 1923). The heater is composed of a number of individual seamless copper tubes, the ends of which are expanded into a hexagonal outline. In appearance it resembles certain radiators of the automobile type. It is notable for its compactness and lightness, and is designed to contain the maximum number of square feet of prime radiating surface with the least amount of cubilar content, at the same time keeping the air frictional loss low, especially at velocities of 900 ft. per minute and over.

Fig. 1 shows the present construction of this heater. As already explained, the heater is composed of individual extruded copper tubes, the ends being expanded and sealed with special alloy. Steam is admitted to the core through brass headers supplied with pipe fittings, while the condensation is taken care of in a similar manner. The sides are made tight and at the same time are reinforced by heavy brass plates not only to prevent the escape of steam but to act as braces for expansion stresses.



Section Through Cellular Type of Copper Heater.

The results indicated below were all made in an especially designed wind tunnel 21½ ft. long with the heater in the center. Especial care was taken in smoothing the inside walls and in providing a straightener to avoid eddy currents and to minimize, if not eliminate, all possible errors.

Very briefly, some of the results obtained are shown here:

FINAL TEMPERATURES AND CONDENSATIONS

Steam 227° F. 5 lbs. gauge
Air Entering—10° F. to 70° F.
Velocity through Heater in feet per minute,
Measured at 70° F. and 29.92 in. Mercury

3-in. Tube

Temperature of Entering Air Deg. F.	1200 Final Temp. Deg. F.	1200 Condensation Lbs.	1800 Final Temp. Deg. F.	1800 Condensation Lbs.	2400 Final Temp. Deg. F.	2400 Condensation Lbs.
0	57.16	1.77	55.44	2.58	53.57	3.32
20	72.03	1.61	70.51	2.35	68.81	3.03
40	87.00	1.46	85.64	2.12	84.09	2.73
60	102.0	1.30	100.8	1.90	99.38	2.44
70	109.5	1.22	108.3	1.78	107.0	2.30
Friction Loss, in.	0.110		0.230		0.385	

3⅞-in. Tube

	1200		1800		2400	
0	68.89	1.67	67.71	2.46	65.33	3.16
20	82.82	1.52	81.75	2.24	79.58	2.88
40	96.76	1.38	95.79	2.02	93.83	2.60
60	110.7	1.23	109.8	1.81	108.1	2.33
70	117.6	1.15	116.8	1.70	115.2	2.19
Friction Loss, in.	0.130		0.270		0.450	

5-in. Tube

0	77.71	1.47	78.34	2.20	75.30	2.84
20	90.9	1.34	90.79	2.00	88.68	2.59
40	104.0	1.21	104.0	1.81	102.0	2.34
60	117.2	1.08	117.1	1.62	115.4	2.09
70	123.8	1.01	123.7	1.52	122.1	1.97
Friction Loss, in.	0.140		0.300		0.511	

6-in. Tube

	1200		1800		2400	
0	83.22	1.31	83.50	1.98	81.83	2.58
20	95.90	1.20	96.15	1.80	95.08	2.36
40	108.6	1.08	108.8	1.63	107.8	2.13
60	121.2	0.97	121.4	1.46	120.6	1.90
70	127.6	0.91	127.7	1.37	126.5	1.79
Friction Loss, in.	0.157		0.328		0.550	

These heaters average approximately 0.4 lbs. per square foot of radiating surface and per cubic foot of net space occupied contain an average of 110 sq. ft. of radiating surface, almost all of which is prime, i.e., exposed to the flow of steam on one side, and to air on the other.

Finally, the results obtained may be briefly set down as follows:

1. For about 14% of the space occupied and about 12% of the weight of standard cast-iron heaters, tests show that Cartridge heaters can deliver a greater number of B.T.U. for equal air frictional losses.

2. The heat-dissipating properties of the Cartridge heater are not proportional to the air frictional losses.

3. Air frictional losses through Cartridge heaters follow the law that the losses vary as the square of the velocity, but are considerably less, varying as the 1,825 power only.

4. For equal air frictional losses, and with the same amount of air flowing through them, the Cartridge heater, per square foot of surface, is about equal in dissipating qualities to cast-iron at a velocity of 900 ft. per minute, gradually increasing as the velocity increases, when at 2900 ft. per minute its heating value according to tests is 48% higher than cast-iron.

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SUFFICIENT time has elapsed since the momentous decision made by the American Society of Heating and Ventilating Engineers, last January, to continue its Heating Research Laboratory, for one to estimate, in a general way, its effect on the course of the industry. In the first place, it means that the excellent investigations of fundamental causes and effects connected with air conditions, already started at the Laboratory, will be continued and, as far as possible, brought to a conclusion. In the second place, it means that the hundred and one avenues of investigation disclosed in the course of the research work, we may reasonably expect, will be followed to see where they lead and thus, no doubt, open up new lines of thought and perhaps of practice in the field of heating and ventilation. Finally, through the aid of other investigations initiated by the Laboratory and carried on at other institutions, such as universities and technical schools, a mass of practical field data will be forthcoming which can be threshed over and interpreted by the Research Laboratory.

But after that has all been done, what then? Are we to stop there and let those interested in the use of the findings grope their way through them and translate them into bread-and-butter notes that can be used in their everyday work? Or, to put it another way, is all this material to remain in its pristine condition and be filed away in the society's technical storehouse, to be tapped mostly by professional or scientific men?

In short, what are we going to do with the remarkable information which the Research Laboratory is gathering?

This is a fair question because the Research Laboratory is dealing with a subject which has a popular appeal for practically everyone. Moreover, the Research Laboratory is now over five years old and the papers dealing with the results of its investigations are already sufficient in number to fill a good-sized volume. But where are they? It must be admitted that for the most part they are preserved in their original text in the archives of the society.

Those who have appreciated and understood the facts brought out have used them, with distinct advantage in many cases, but to the rank and file of the industry, or even the profession, they remain, to too large an extent, a closed book.

SO MONUMENTAL a work as that the Research Laboratory is doing will never bear full fruit unless and until (1) the data derived from its investigations are put into practical form so that the average man in the industry may use them, (2) the broad findings of the Laboratory are spread before the general public in a way in which they will be understood and (3) the Laboratory's investigations are made in a way that will arouse public interest.

We have already referred in these columns to the effective manner in which the warm-air furnace manufacturers have gone about their research work by building a Heating Research Residence. Now they propose a plan for an educational publicity campaign which will involve the employment of a paid director of publicity.

Why is the application of this plan any more appropriate for the warm-air furnace industry than for the heating and ventilating industry? Why would not such a move be a good means of making the Research Laboratory data more generally available to the engineering world and, in a general way, to the public? Why not an A. S. H. & V. E. Research Residence?

It is manifestly unreasonable to expect the Research Laboratory to conduct the publicity work here suggested. It is a different kind of undertaking altogether. But as the Laboratory approaches a renewal of its activities, the importance of "getting over" its findings is becoming more fully realized and the conviction is coming home to many that there is a "missing link" here between the Research Laboratory and the rank and file of the industry which could be supplied by some one, call him what you will, of a practical engineering turn of mind, close to the heating and ventilating field and its ways, who could form the necessary liaison between the Research Laboratory and the engineering and general public. For the want of a better name, we will call him an Engineering Publicity Director.

Heating and Piping Contractors—This Is Your Job!

Keep Your Industry Where It Belongs, in the Hands of Steamfitters

At the 1923 Convention of the Heating and Piping Contractors National Association a printed report was submitted by a Committee on Apprentices, headed by William H. Oakes and including Walter Klie, W. A. Polk and J. E. Rutzler. This committee report opened with the words, "Careful investigation into the needs of our industry having fully demonstrated the fact that there exists a dearth of skilled craftsmen—", and proceeds to quote the resolution adopted by the 1922 convention at Buffalo.

The report further states: "The committee is unanimous in the opinion that this need of skilled mechanics is really urgent and that it is, therefore, imperative that this association shall take immediate steps to put into operation some plan for the adequate training of young men, so that the industry may be fully assured, in the future, of an ample supply of men to intelligently carry on its work."

The report of the committee outlines a general program of action, recommends the setting up of a list of jobs to be learned, and indicates that a nation-wide campaign of apprenticeship should be followed.

NEED FOR APPRENTICES TO-DAY AS GREAT AS EVER

Two years have passed since this report was adopted by the Heating and Piping Contractors National Association. So far as can be learned, no use has been made of the excellent work of this committee. It may be helpful to consider some of the points that were raised in this report.

If an urgent need for mechanics existed in 1923, that need is much greater to-day. A recent survey made by the National Trade Extension Bureau shows that there are not more than 38,000 steamfitters in the United States. This means that the trade is losing at least 420 steamfitters a year by death, to say nothing of losses from other causes, such as going into business, and entering other lines of work. At least 1,500 mechanics a year are lost in the steamfitting trade.

How are these losses to be made up? To-day the requirements of the steamfitter's work demand a great deal of technical knowledge. A fitter's worth to his employer is in direct proportion to his understanding of the technical side of the trade. It is perfectly evident that this technical knowledge cannot be gained by work at the trade alone; it is necessary that the person learning steamfitting shall have some definite planned opportunity to study the technical side of the trade.

ONLY 577 STEAMFITTER APPRENTICES IN SCHOOL IN 1923-24.

In 1923-24 in all the United States there were only 577 steamfitter apprentices or learners in school. According to the best data more than half these boys will not complete their studies and so become journeymen. These 577 boys are scattered throughout four years of apprenticeship, which means that not more than 150 can be turned into the trade in any one year. Only 75 new journeymen at most can be produced each year, because of the dropping out which was mentioned above. Thus, the training forces of the country, due to lack of a national pressure, are producing but one journeyman a year, while 20 are being lost in the same period. At this rate, how long will it be until the steamfitters' numbers are reduced to the danger point?

Compare this situation with the development in the training of apprentice plumbers. A recent study has shown that the national program of the plumbers is resulting in the establishment of approximately 25 schoools this year, with an increase of at least 1,000 in the number of apprentices that are being trained in the technical and practical phases of the trade. This encouraging growth has taken place as a direct result of the well-planned campaign carried on by the Apprenticeship Committee of the National Association of Master Plumbers.

With approximately 100 schools for apprentice plumbers, contrast three schools for steamfitters' helpers. Ninety per cent. of the steamfitters' learners will be found in the public vocational schools of Chicago and Los Angeles and in the New York Trade School. With over 5,300 apprentice plumbers now in training, contrast a bare 600 steam fitter helpers. With an industry that is beginning to train adequate replacements, contrast an industry that is training but one replacement for every twenty vacancies that occur.

ARE EMPLOYERS AWAKE TO ACTUAL SITUATION?

What are the causes of this failure to provide adequate facilities for training steamfitting learners? The 1923 committee thought it unnecessary to discuss at length the reasons which have brought about existing conditions. The conditions which hindered development in 1923 still exist, and these factors are as effectively hindering action to-day as in 1923. Employers still feel that apprentices cost them money. They do not understand the bet-

ter ways of training apprentices, whereby the boy becomes an asset from his first day of actual work. some prominent and influential association executives in the heating field still hold belief that the journeymen's organization is against apprenticeship. This may be true in one or two cities; but in the country at large the journeymen's organization has generally shown more willingness to cooperate in a sane program of apprenticeship than have the employers. In 1923 the heating contractors' association expressed the need for a definite, national program of publicity, preparation of teaching material, training of instructors of appentices, organization of schools for apprentices and investigation of conditions. That same need exists today.

CRYING NEED FOR ACTION.

What the heating and piping contractors need is a national movement for apprentice training, directed from a central point, furnishing material, publicity and suggestions so that communities may put into practice modifications that will fit local needs. Until such a national program is adopted, until such material is made available for local use, the heating and piping contractors will suffer from an increasing lack of competent journeymen, which, if continued many more years, will mean the serious curtailment, if not the actual death, of the industry from lack of workers to carry on the business.

The time has come when the heating industry must face the question of apprenticeship. The time has come to see the need for training and to provide the funds to meet that need on a national basis. The time has come for adoption of a national apprenticeship plan, with financial support, by the Heating and Piping Contractors' National Association.

National District Heating Association

Program for Annual Meeting

What Secretary D. L. Gaskill describes as one of the best programs that has ever been presented to the members has been arranged for the forthcoming sixteenth annual convention of the National District Heating Association at West Baden Springs Hotel, West Baden Springs, Ind., Tuesday, Wednesday, Thursday and Friday, May 19-22. All sessions will be in the morning and the afternoons will be given over to social features. Following is the program in full:

TUESDAY MORNING, MAY 19

President's address.
Reports of secretary-treasurer, secretary and executive committee.
Appointment of Nominating Committee.
Reports of Educational Committee and Corrosion Committee.
Address, "The Engineer as a Community Asset," by Professor James D. Hoffman, of Purdue University.
Manufacturers' "Round Table."

WEDNESDAY MORNING, MAY 20.

Report of Station Operating Committee, R. G. Felger, Detroit Edison Company, chairman.
Address by C. H. Berry, of the Detroit Edison Company.
Report of Operating Statistics Committee, J. C. Butler, Illinois Maintenance Company, chairman.
Address by L. E. Young, of the Union Electric Light & Power Co., St. Louis.
Manufacturers' "Round Table."

THURSDAY MORNING, MAY 21.

Report of Heat Utilization Committee, J. E. Seiter, Detroit Edison Company, chairman.
Address by Earle Schulz, past president of the National Association of Building Owners and Managers.
Address by L. W. Wallace, of the American Engineering Council, Washington, D. C.
Report of Heating Research Committee, Earle Schultz, Illinois Maintenance Company, chairman.
Manufacturers' "Round Table."

FRIDAY MORNING, MAY 22.

Report of Hot Water Heating Committee, R. C. March, Public Service Company of Northern Illinois, chairman.
Address by A. C. Marshall, vice-president and manager of the Detroit Edison Company.
Report of Rates and Regulations Committee, F. A. Newton, Commonwealth Power Company, Jackson, Mich., chairman.
Report of Distribution Committee, O. W. Kastens, Consumers Power Company, Grand Rapids, Mich., chairman.
Manufacturers' "Round Table."
Election of officers.

Special attention is called by the officers to the manufacturers' "round table" feature. Heretofore part of a single session has been devoted to the presentation by manufacturers of new appliances and inventions of particular interest to the district heating industry. The fact that there was not sufficient time for the presentation of all the devices listed has led the officers to set aside a period at each session when the manufacturers will have their innings. This is expected to provide some of the most practical data of the meeting.

Iowa's Schools of Ventilation

How Iowa is teaching the people in the rural districts the principles of good ventilation as applied to farm buildings, is explained in a statement received from Professor H. H. Sunderlin, extension associate professor of agricultural engineering, in the Iowa State College of Agriculture and Mechanic Arts.

These schools, states Professor Sunderlin, are usually in the form of a demonstration in the rural districts, although sometimes they consist of talks in community buildings in the evening.

The demonstration consists in going to the farm where previous arrangement has been made beforehand with the owner who has the necessary material on hand in order to conduct or build part of the ventilation system in the various types of farm buildings.

The building generally worked on is the hog house as it lends itself more readily for demonstrating purposes. Considerable of the system is constructed in the morning and then in the afternoon an open meeting is held for the neighbors. Here the principles of ventilation in a hog house are discussed, not only for the type of building that worked on, but for the others as well. It often happens that the aid of the county agent an entire ventilation system is installed in that particular type of building.

It often happens that previous arrangements have been made for holding a night meeting. At these night meetings there is generally a mixed audience, so the talk on ventilation consists of general ideas bringing in the home more than is done in the afternoon discussion.

One of the things emphasized is the humidity of the air in homes and great need for it. Oftentimes when the meeting is thrown open for discussion, the question of a heating plant is brought up.

The main idea of the ventilation schools and the evening discussion is to get the people to realize the importance of ventilation after which they will demand that some attention be given to this important subject.

Oil Burner Men Hold Second Annual Convention

Rapid Strides of the Industry Reflected in the Attendance and Variety of Subjects Discussed—Association Changes Name and Employs Technologist

FROM the point of numbers, enthusiasm and papers of value, together with exhibits indicating the present status of development, the second annual convention of the American Association of Oil Burner Manufacturers, held in Chicago April 1, 2 and 3, was a huge success. According to action taken at the business session, the organization hereafter will be known as the American Oil Burner Association. Another important step, looking towards the development of the technical side of the industry was taken in the appointment of a full-time technologist. The man selected for this position is J. T. B. Bowles, formerly identified with the Tidewater Oil Company, of New York.

The convention program was well-considered in that practically every vital phase of interest to convention members was the subject of one or more papers. One suggestion which might be made, based upon the experience of this gathering, is that at a convention where exhibits form an important factor and where sales and other contacts must be made, a morning and afternoon program of papers hardly allows those interested in the proceedings to devote sufficient time to the exhibits, and vice versa. While the prime reason for a convention of manufacturers is to get together for a consideration of mutual problems, it was evident to all who attended this convention that the exhibits themselves formed no small part of the value of the gathering.

Another point worthy of consideration in this connection is the fact that the apparatus shown is of interest to visitors within the industry and also to the general public in the particular city where the convention is held. It would seem worth while, even at this early stage in the life of the association, to provide at least one entire afternoon when the exhibit section would be open only to members of the convention and their inspection of the other fellow's handiwork not be hampered by the crowds present at a public showing.

As was perhaps to be expected with such a new association, many of the excellent papers presented brought out but little discussion. As the association grows older, no doubt, the members will feel more free to get up and tell their methods, their findings, and what they may now consider trade secrets. It is fair to predict that the spirit of good fellowship, in a commercial sense, which manifestly pervaded this convention, will soon bring the association to the point where the members will thresh out at the various sessions the vexing problems that accumulate during the year.

C. H. Chalmers
President of the American Association of Oil Burner Manufacturers.

Mr. Chalmers is an electrical engineer, having received his degree of E.E. from the University of Minnesota, in 1894. From 1897 to 1910 he was vice-president and general manager of the Electric Machinery Company, of Minneapolis, Minn. During the World War he was with the Treasury Department on W.S.S. work. He entered the domestic oil-burning field in 1920.

One of the outstanding papers presented at the convention was on "Analysis of Oil Flames," by James L. Breese, Jr., of Chicago. As a contribution to the all too scanty technical knowledge of fundamentals, it was admittedly of inestimable value. Mr. Breese presented in a few minutes a resume of long and painstaking laboratory work—a scientific study, yet definitely pointing the way to a conception of practical considerations which must be understood by every oil burner engineer. There is considerable room for research work in connection with oil burning, and this paper furnishes an ideal starting point.

OPENING SESSION, APRIL 1.

The various sessions of the convention were held in the ballroom of the Edgewater Beach Hotel. President Edward P. Bailey, in his opening address, spoke of the development of the past year and the hopes of the association for the future. One point made by President Bailey is worthy of emphasis. He referred to the tremendous increase in the sales of oil burners, not with pride and congratulations, but with a caution that continued growth at this rate would undoubtedly prove detrimental to the industry, and ultimately add greatly to the sales resistance to be met. The reaction from the careless sale and even more careless installation of burners can only be a measure of the dissatisfaction caused by the resulting failure of the burners to properly perform their function. This same thought was voiced throughout the convention, and the seed sowed by the retiring president will undoubtedly bear fruit.

C. H. Chalmers, of the Chalmers Oil Burner Company, Minneapolis, Minn., later elected president of the association, in a paper on "Standard of Ethics and Practice for the Oil Burner Industry," voiced a plea for a definite code of ethics to govern the business of association members. A code was suggested to which no manufacturer with the ultimate good of the industry at heart could fail to subscribe. The theme of the code was a plea for the elimination of the practice of decrying the burners built by the other fellow. This kind of salesmanship has long been condemned in the automotive field, for instance, and has no place in any competitive business. As Mr. Chalmers said, there is room for the honest exploitation of every honest burner now on the market.

"Oil Burning in Canada," was the subject of a paper by Lionel L. Jacobs, of the Fell Oil Burners of Canada. The remainder of the session was given over to the committee reports, including the report of the Committee on Underwriters' Standards," J. H. Hirsch, chairman; and of the Committee on Simplification and Nomenclature," G. H. Rittenhouse, acting chairman. The latter report was presented by W. L. Huff, of the Honeywell Heat Specialties Company.

In discussing underwriters' standards, Mr. Hirsch recommended close co-operation with the Underwriters' Laboratories, Inc., in its efforts to minimize fire hazards. Although the Underwriters' Laboratories cover only one phase of the burner manufacturers' responsibility to his customers, that of the element of safety, nevertheless, as he stated, the element of safety is of primary importance to the burner manufacturer.

MORNING SESSION, APRIL 2.

Papers presented at the Thursday morning session included "Some Reflections on Basic Engineering Experience in Oil Burning," by John P. Leask, of the Peabody Engineering Corporation, New York; "Analysis of Oil

Flames," by James L. Breese, Jr., Breese Engineering Corporation, Chicago, and "Uses of Portable Oil-Burning Equipment," by George P. Kittle, of the Aeroil Burner Company, Union Hill, N. J.

AFTERNOON SESSION, APRIL 2.

At the afternoon session an interesting paper on the supply of suitable oil fuel to the consumer was read by C. E. Dowd, of the Lynch-Clarissy Oil Compan, Chicago. Mr. Dowd brought out many points in connection with the often neglected factor of getting oil after the burner is installed.

According to Mr. Dowd, the failure to consider such items as the best location of filling cap, its frequent location requiring a heavy oil truck to enter a lightly-constructed private driveway, not designed to carry such a weight, and other seemingly unimportant considerations, actually add to the cost of fuel. The folly of attempting to save money by installing small storage tanks also makes the same fuel cost more, as it bunches the oil deliveries up into a space of four months. A full understanding and appreciation of such points by the oil burner salesman would, in the long run, mean a saving to the consumer.

G. C. Pledger, of the Williams Oil-O-Matic Heating Corporation, in a paper entitled, "Training Dealers and Installation Engineers," told of the success of the Williams organization in training service men.

Other speakers at the Thursday afternoon session were E. J. Smith, of the Underwriters' Laboratories, Chicago, who discussed "Installation Standards," and George W. Lee, of the Foamit-Childs Corporation, Utica, N. Y., who discussed "The Answer to the Coal Man's Propaganda."

Mr. Smith urged the burner men to join the National Fire Protective Association on the ground that the best way to have a voice in the formation of fire-prevention rules is for interested parties to join the association. Mr. Lee declared that the answer to the coal men's propaganda is a clean fire record. One fire, he declared, in an establishment where an oil burner is used, does the oil burner business more harm than all the knocks of all the disgruntled coal men in town put together.

Wallace C. Capen, of St. Louis, first president of the association, went "on the air" during this session and his talk on oil burning evidently found a number of interested listeners with their dials set at the proper number, for the next day saw the attendance approach the thousand mark.

MORNING SESSION, APRIL 3.

Papers presented at the Friday morning session included one on "What About the Dealer?" by L. P. Ordway, of the Winslow Boiler & Engineering Company, Chicago; one on "The Year's Progress with Temperature and Heat Controls," by W. L. Huff, of the Honeywell Heat Specialties Company, Wabash, Ind., and one on "Heating Problems and Oil Burning," by Homer Linn, of the American Radiator Company, Chicago, and president of the Illinois Chapter of the American Society of Heating and Ventilating Engineers.

Mr. Linn discussed particularly the use of oil burners in existing heating plants. The oil burner, he pointed out, is not a cure-all for a primarily defective heating plant. When a burner is installed in a warm-air furnace the casing and piping should be removed, thoroughly cleaned and the castings recemented. Mr. Linn urged the use of the installation code of the National Warm-Air Heating and Ventilating Association in checking installations of warm-air furnace systems.

Mr. Linn proposed the adoption of a uniform data sheet giving detailed information on the building to be heated. Oil burner installations, he said, require more service than coal-burning installations and the average salesman is not qualified to give the necessary service.

Discussing oil burner efficiency, this question stated Mr. Linn, has not yet been settled and he quoted four tests using the same types of burners in four boilers, with varying results. The discussion following Mr. Linn's remarks emphasized the need of having heating and ventilating engineers on the staffs of the oil burner manufacturers.

Still another paper presented at this session was on "Putting the Sale into Salesmen," by E. George Moak, of the Automatic Burner Corporation, Chicago.

AFTERNOON SESSION, APRIL 3.

The last session of the convention brought out the most active discussion of the entire meeting, on the general subject of "Tanks." "Facts About Galvanized Tanks, and Their Installation," were presented in a paper by Edgar A. Bienenstok, of the Milwaukee Tank Works, followed by a paper on "Facts About Black Tanks, and Their Installation," by A. A. Butler, of the Gtaver Corporation, Chicago. The advantages of galvanized tanks for buried jobs were emphasized by Mr. Bienenstok, while Mr. Butler had some strong points to make regarding black steel tanks. Mr. Butler stated, among other things, that his firm had never installed a tank under a basement floor in Chicago. In every case such installations have been made in the customer's coal bin, this arrangement being permitted in Chicago. Mr. Butler spoke particularly of the need of adequate vent lines in tanks, and of the desirability of cleaning up the customer's premises after making an installation.

The meeting closed with the presentation of a talk, illustrated with motion pictures, on "Proper Venting of Oil Tanks," by R. J. Anschicks, of the Protectoseal Company, Chicago, and an address on electric motors, by L. E. Berry,

Convention Photograph of American Association

of the Jannette Manufacturing Company, Chicago. Mr. Anschicks showed the use of a number of safety appliances and discussed at length the venting of oil tanks. Mr. Berry urged the use of repulsion type motors for pumping service and gave hints on securing silent running of the motors and satisfactory lubrication.

NEW OFFICERS

At the business meeting of the association held Thursday afternoon, the following officers were elected:

President, C. H. Chalmers, Chalmers Oil Burner Co., Minneapolis, Minn.

Vice-presidents: John P. Leask, Peabody Engineering Co., New York; Lionel J. Jacobs, Fess Oil Burners of Canada, Ltd., Toronto, Ont.; E. J. Smith, Hill Mfg. Co., Chicago; Wallace C. Capen, Home Appliance Corp., St. Louis, Mo.; and J. L. Voorheis, Coen Co., San Francisco, Calif.

Directors: Edward P. Bailey, National Airoil Burner Co., Philadelphia, Pa.; H. A. Tiffany, Tiffano Oil Burner Co., Newark, N. J.; J. C. Johnson, S. T. Johnson Co., Oakland, Calif.; George P. Kittle, Aeroil Burner Co., Union Hill, N. J.; and J. L. L. McCormack, Hardinge Bros., Chicago.

Executive Committee: President C. H. Chalmers, Retiring President Edward P. Bailey and Executive Secretary Leod D. Becker.

Leod D. Becker was reappointed secretary.

Convention Notes

On the evening of the first day the Chicago members of the industry acted as hosts to the visitors in an informal entertainment and buffet luncheon in the ballroom of the Edgewater Beach Hotel. The members, dissolving into natural groups, were served with many dainties and provided with dance music, the entertainment winding up with a sketch by stars from the Chicago theatres. As the columnist has it, "a good time was had by all."

One of the interesting features of the convention was a visit to the Underwriters' Laboratories, where the guests were taken in groups through the magnificent building and shown the work being done that the interests of the nation be served. Naturally, the greatest interest was taken in the two rooms where oil burners were under test. Many of the visitors were manufacturers who had only the vaguest conception of what tests were made, and this feature was undoubtedly of no small value to them.

This visit tied nicely into the paper by E. J. Smith of the Laboratories, who suggested that, at first, the work of the Laboratories might have been viewed with distrust by the manufacturer who was looking for some possible ulterior motive. It would seem improbable that, after the paper by Mr. Smith and the visit to the Laboratory, any one could question the value to the industry, as well as to the country at large, of the closest co-operation between manufacturers and the Underwriters' Laboratories.

As one manufacturer expressed it, when asked about his impressions of the convention, as compared with the one of a year previous: "At St. Louis there was a great deal of general interest. At this convention it seems to have crystalized into 'buying interest.'"

Secretary Leod D. Becker, who took a prominent part in the organization of the association, was paid a warm tribute when he was presented with a gold watch by the president of the association in appreciation of his services.

Convention Exhibits

Honeywell Specialties Co., Wabash, Ind.—heat control specialties and equipment. M. C. Honeywell, W. L. Huff, A. P. Mudgett.

Minneapolis Heat Regulator Co., Minneapolis, Minn.—C. B. Sweatt, H. W. Sweatt, B. L. Boalt.

Home Appliance Corp., St. Louis, Mo.—Scott-Newcomb system electrol ignition electrol burner, oil burner boiler, water heater and garbage incinerator. Wallace C. Capen.

Basel Mfg. Co., Kansas City, Mo.—oil burner valves and heat regulators. E. A. Basel.

Jannette Mfg. Co., Chicago—oil burner motors.

American Radiator Co., Chicago—oil-burning boiler. Homer Linn.

Aetna Automatic Oil Burner Co., Inc., Providence, R. I.—centrifugal rotary oil burner.

W. B. Wilde Co., Peoria, Ill.—Hart automatic oil burner.

Federal Gauge Co., Chicago—Mercoid switches, controls and thermostats. James Owens.

Ft. Wayne Eng. & Mfg. Co., Ft. Wayne, Ind.—Paul oil pumps.

Chicago Steel Tank Co., Chicago—oil-storage equipment.

American Blower Co., Detroit, Mich.—Sirocco blowers and fans.

Oil Products Appliances Co., Maywood, Ill.—fuel-oil storage unit and pump.

Copeland Products, Inc.—iceless refrigeration.

Webster Electric Co., Racine, Wis.—Webster oil-burner coil.

Plibrico Jointless Firebrick Co., Chicago—jointless furnace lining.

S. T. Johnson Co., Oakland, Cal.—Johnson rotary oil burner.

Reliance Gauge Column Co., Cleveland, O.—low-water alarm.

Blackmer Rotary Pump Co., Petoskey, Mich.

Tiffany Oil Burner Co., Newark, N. J.

Kruse Co., Indianapolis, Ind.—Newport oil-burning boiler.

Leader Iron Works, Decatur, Ill.—tanks.

of Oil Burner Manufacturers

Cook Electric Co., Chicago, Ill.—oil pumps and burner accessories.
Valley Electric Refrigeration Co., Buffalo, N. Y.—electric refrigeration.
Absolute Con-Tac-Tor Co., Beloit, Wis.—Hi-voltage controls for oil burners, refrigerators, sprinklers.
The Beckwith Co., Dowagiac, Mich.—Round Oak automatic fuel-oil burner.
Leiman Bros., N. Y. City—pumps.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.—Oil-O-Matic burners.
Home Incinerator Co., Milwaukee, Wis.
Wagner Electric Corp., St. Louis, Mo.—Wagner electric motors.
Minn.

Convention Comments

By HOMER R. LINN, engineer, western executive office of the American Radiator Company.—The convention, it appeared to me, had several outstanding features.

First, the papers were well written, constructive and well delivered. Some of these papers pointed the way to fundamental principles in the design and construction which, if followed, will do much to putting domestic oil burners on a more economical and scientific basis. The keen attention and animated discussions showed they were appreciated.

Second, the good fellowship and kindly feeling manifested throughout all of the meetings by competitors, both among the oil-burner manufacturers and accessories manufacturers, proves beyond a question that the association has accomplished much that it originally set out to do.

Third, the class and arrangements of exhibits were much better than a year ago and clearly showed a decided progress in oil-burning equipment. It is predicted that there will be twice as many exhibitors next year, due largely to the interest shown by members and visitors this year.

Fourth, the work of the association the past year was very creditably and efficiently carried on by the officers, just retired. The work already outlined and undertaken by the incoming officers cannot help but make the American Oil Burners Association the leading factor in the development of the oil-burner industry the coming year.

May I also add that the publicity given the papers and deliberations of the association by the technical press is a big help to the association.

Standardization Work in Screwed Pipe Fittings

One of the projects to be submitted to the Heating and Piping Contractors National Association at its annual convention at Detroit, June 1-3, is a proposal to determine "dimensional standardization, exclusive of screw threads, of pipe flanges and flanged fittings; and standardization of screwed pipe fittings, for pipe carrying steam, gas, air, ammonia, water, etc."

The Sectional Committee representing the association has submitted to the Joint Sponsors for final approval three proposed standards on the following:

Malleable iron screwed fittings for maximum steam pressure of 150 lbs. per square inch.

Cast-iron screwed fittings for maximum steam pressure of 250 lbs. per square inch.

Cast-iron screwed fittings for maximum steam pressure of 125 lbs. per square inch.

These proposed standards have already received the approval of the board of directors of the association.

American Society of Heating and Ventilating Engineers

Plans for Society's Atlantic City Meeting

Plans for the forthcoming semi-annual meeting of the American Society of Heating and Ventilating Engineers, in Atlantic City, June 15, 16 and 17, provide for a liberal interspersing of social activities between the various professional sessions. The meeting has purposely been arranged for Monday, Tuesday and Wednesday to permit those attending to enjoy the resort during the balance of the week. Headquarters will be at the Hotel Traymore.

Committees representing the Philadelphia and New York Chapters will have charge of the entertainment features of the meeting. The New York Chapter committee is headed by Alfred Engle.

University Students Guests of the Western New York Chapter

Forty-nine senior students in the engineering course at the University of Kentucky, accompanied by Dean F. Paul Anderson and five professors, were the guests of the Western New York Chapter at its April meeting at the Hotel Buffalo, Buffalo, N. Y., April 6. Over a hundred members and guests sat down to dinner and it was generally agreed that the meeting marked a gala night for the Western New York Chapter. President W. G. Fraser acted as toastmaster and the evening was given over to entertainment and good fellowship.

New York Chapter Discusses Heat Economies in Paper Making

An entirely new method of lowering the heat and air load in paper making, which has recently been perfected, was described at the April meeting of the New York Chapter, held April 20 at the Building Trades Employers' Club. N. A. Hollister, of Drying Systems, Inc., of Chicago, was the speaker of the evening, his subject being "Air and Heat in Paper Making."

Mr. Hollister told of the enormous amount of heat required for evaporating the moisture from the wood pulp and of how most of this heat was formerly wasted after passing through the rolls. This waste was considered necessary in order to prevent condensation from the saturated air within the building.

The new process, he described, is in the nature of a closed system in which the heated and saturated air, after leaving the rolls, is recirculated, first passing through a heat exchanger in which water is heated for domestic service and the condensation from the air carried away. Mr. Hollister's talk was illustrated by mirroscope views.

New chapter officers elected for the ensuing year are as follows: President, A. A. Adler; vice president, R. H. Carpenter; secretary, E. B. Johnson, treasurer, F. E. W. Beebe. Board of Governors: William J. Olvany, retiring president; Thomas J. O'Donnell and H. B. Kahn.

Toronto Chapter to Make School Ventilation Tests

As the result of a discussion of air requirements for school buildings, at the March meeting of the Toronto Chapter, the chapter passed a motion that it conduct tests in the new schools in Toronto during vacation time, with the object of arriving at some fixed standard that can be followed in connection with other ventilation. The matter came up for discussion through a telegram received from the Ohio Chapter meeting in Cleveland which read:

"Attempt being made to change the Ohio heating and ventilating code to only 10 cu. ft. of air per minute per pupil. What are the requirements of your province? From your experience what do you think should be the minimum requirements?"

A number of opinions were offered by the members and a reply finally drafted as follows:

"Present requirements of the province are 30 cu. ft. per minute per pupil."

It was brought out that while 30 cu. ft. is the practice generally followed there is a tenedency to reduce this figure to cut coal consumption. The decision to conduct tests in Toronto school buildings was then made.

Warm-Air Furnace Manufacturers Get First Data from Heating Research Residence

Formulate Plans at Annual Meeting to Broaden Scope of Publicity Bureau and to Appoint Publicity Director— Old Officers Re-Elected

MEMBERS of the National Warm-Air Heating and Ventilating Association, who met in Cleveland, April 15-16, for their twelfth annual convention, received the initial data which have been obtained from tests conducted at the association's new Heating Research Residence, in Urbana, Ill. The event marked the first return to the association for its large outlay in the construction and equipment of the residence and furnished an impressive indication of the importance of this work, not only on its effect upon the progress of the warm-air furnace industry, but on the science of heating and ventilation itself. Professor A. C. Willard and two of his aides, Professor A. P. Kratz and Professor V. S. Day, who have had direct charge of this experimental work, handled the presentation of the data and were kept busy, especially during the last afternoon of the meeting when discusson was rife.

The reaction on the convention caused by the appearance of information of such practical value from the Heating Research Residence was seen in the unanimous approval by the meeting of a suggestion made by the association's Educational Research Bureau, that the time had come to initiate a properly-equipped Publicity Bureau, with a paid Director of Publicity. In addition, the convention voted a substantial appropriation to carry out the suggestions outlined by the bureau.

It was very evident, from the discussion, that many of the members had, in the past, looked upon the Heating Research Residence as of doubtful value to the furnace manufacturers, but the data so far obtained—and it represents only the work of a portion of one heating season, have gone far to dispel any lingering doubts.

The general heating test made of the residence proved conclusively that a house of this size and type can be maintained at 70°F., with almost no variation of temperature, during an Illinois winter, without forcing, and with a remarkable high over-all efficiency.

OPENING SESSION, APRIL 15

President E. B. Langenberg opened the meeting, Wednesday morning at the Hollenden Hotel, Cleveland. Following the necessary routine business he presented his address. One of the principal points made in his address was the need of capitalizing the achievements of the industry through "educational publicity." "We have a message —a big message," he declared, "to tell the public. Ways and means should be thought out at this meeting and action taken to realize on this, one of our biggest assets." He referred to the proposed national exposition of heating and ventilating apparatus, scheduled to be held in New York next January, and urged that if the plans were carried out, the warm-air furnace industry should take advantage of the opportunity to have their products displayed among the exhibits.

Another proposal made by President Langenberg was the establishment of a heating congress, consisting of representatives of the various national societies interested, including the American Society of Mechanical Engineers and the American Institute of Architects, to meet once or twice each year at some central point. In connection with such a heating congress he proposed the publication of a special bulletin, to be issued monthly through the secretary of the congress to the entire membership of all affiliated bodies. The specific function of such a congress, he defined, would be the collection and assembling of commercial, scientific and educational information and the dissemination of information regarding new developments.

The Heating Research Residence, declared Mr. Langenberg, is rapidly proving the justification of the idea that determined its construction. He expressed the appreciation of the entire organization to the research staff.

Secretary Allen W. Williams, in his

Dinner of National Warm-Air Heating and Ventilating Association at the Hotel Hollenden, Cleveland, April 16.

report, quoted from data showing that the value of warm-air furnaces made during 1923 was $43,168,883. His report showed an increase in the number of furnaces purchased in 1924, as compared with 1923.

Figures for the total investment in the Heating Research Residence, furnishings instruments and testing apparatus, as given by Secretary Williams, were:

Residence	$21,442.49
Furnishings and hangings	1,443.56
Instruments, apparatus, office equipment, etc.	854.00
Estimated value of gifts of furnaces, registers, miscellaneous pipe and fittings	300.00
	$24,040.05

The residence has also been supplied with thermostatic equipment, motors, utility fan for calibrating purposes, draft gauges, auxiliary heater and other small apparatus, consigned without charge by the manufacturers and estimated to cost $425.00.

In accordance with a recommendation of the executive committee, the association voted later to reaffirm its present contract with the University of Illinois for research work for another year.

The morning session closed with the presentation by Professor Willard of lantern slides of the Heating Research Residence, including views of the interior of the residence, the laboratories at the University of Illinois, test data sheets, and views of the apparatus used in measuring and calibrating.

AFTERNOON SESSION, APRIL 15.

One of the features of the afternoon session Wednesday was the address of William A. Gately, of the Division of Simplified Practice, U. S. Department of Commerce, dealing with "Simplification as Applied to the Warm-Air Furnace Industry." Mr. Gately spoke of the desirability of securing such co-operation with the department as would eliminate much of the duplication and unnecessary multiplicity of sizes. He distributed tabulations showing his analysis of the products of about 25% of the manufacturers in the industry. He suggested, based upon his study, that the entire range of fire-pots, for instance, could be reduced from 26 sizes to eight sizes. The same kind of analysis of other items showed similar room for simplification.

Professors Kratz and Day then continued the account of the experimental work conducted at the Heating Research Residence, begun in the morning by Professor Willard.

Professor Willard described the general scheme of the research work already carried out at the University and at the Heating Research Residence. In the laboratory the furnace was first set up and tests run to establish the performance of the plant under laboratory conditions where all the variables could be controlled.

The next step was to move the heating plant to the Research Residence and there to make a 23-day run to determine the efficiency and other points under actual working conditions. The building was utilized as nearly as possible as a residence, excepting that no cooking was done. The furnace operation was controlled by a thermostat located at the breathing line in the living, or control, room.

The discussion on this presentation indicated that the data so far obtained and the figures which will follow will be worth a great deal to those interested in marketing and using warm-air furnaces for heating, as they insure accurate data produced and deduced by highly-trained engineers who are specializing in this research. The American public will ultimately be the beneficiaries, as well as the association behind the work.

MORNING SESSION, APRIL 16.

One of the principal papers presented at the Thursday morning session was by E. S. Hallett, chief engineer of the St. Louis Board of Education, on "Ozone in Residence Heating." This paper aroused considerable interest, inasmuch as Mr. Hallett presented tangible evidence of the benefits derived from ozone by the occupants of the St. Louis schools during the past six years.

L. J. Lewery, of the Sheet-Steel Trade Extension Committee, of Pittsburgh, addressed the convention, telling of the function of his committee, the creation of which was the result of business shrinkage in the sheet-steel industry. He suggested the advisability of having the two organizations work together for the common good.

For the Educational Research Bureau, Chairman E. F. Glore suggested the advisability of conducting an extensive publicity campaign. A general discussion of the matter ended in the division of the association into three groups, representing the eastern, central and western manufacturers, each group reporting full agreement with the plan. The following were appointed as a committee to carry the plan into effect:

Eastern Section: E. F. Glore, Campbell Hodges, H. T. Richardson.

Central Section: A. P. Lamneck, Dr. John P. Wagner and Mr. Wise.

Western Section: R. C. Walker, R. W. Blanchard and Mr. Bridge.

Of this committee E. F. Glore was elected general chairman.

DIRECTOR OF PUBLICITY SUGGESTED

The committee's principal recommendation was the appointment of a Director of Publicity who would give his full time to attending to the duties of the Educational Research Bureau. The committee further recommended that $15,000 be appropriated as a starter to lay the foundation for future work. Incidentally, of the $2,500 appropriated last year, the committee reported that only $1,100 has been used.

The money for the $15,000 appropriation, stated Mr. Glore, could be raised by making a special assessment of $6.00 per unit. In the ensuing discussion, the opinion was expressed that a larger assessment would be needed. The matter was finally disposed of by the announcement that the committee would meet within a month or so, probably in Columbus, to thresh out the matter of the assessment and other preliminaries incident to the employment of a Director of Publicity.

Charles I. Merritt, of Cleveland, O., in a paper on "Salesmen and the Standard Code," brought out the fact that operation under a standard code will work to eliminate cut-throat competition and even, to a certain extent, competitive bidding, as all installations will of necessity have to be of uniform standard, both in regard to materials and workmanship. He also strongly urged salesmen to keep in touch with the developments at Urbana and make the most of the data there developed.

AFTERNOON SESSION, APRIL 16.

The entire afternoon of the last day was devoted to a further presentation of data by Professors Willard, Kratz and Day, and to a general discussion of this subject by the meeting. The association adopted unanimously the Code of Business Ethics of the United States Chamber of Commerce.

NEW OFFICERS

The report of the nominating committee named a ticket based upon "past performances," and, appreciating the suggestion, the ticket was unanimously elected, as follows:

President, E. B. Langenberg, St. Louis.

Vice-president, R. C. Cook, Newark, N. J.

Treasurer, W. P. Cook, Monroe, Mich.

Secretary, Allen W. Williams, Columbus, O.

Executive committee: I. L. Jones, chairman, Utica, N. Y.; H. T. Richardson, New York; J. V. Potter, Sycamore, Ill.; Charles Seelbach, Cleveland, O.; C. A. Olson, Elyria, O.; and C. E. Giessner, Chicago, Ill.

On Wednesday evening the annual banquet of the association was held in the ballroom of the Hotel Hollenden, and was attended by over 200 members and guests. Talks on old times in the association were interspersed with those predicting increasing benefits to be derived from the Heating Research Residence. Other speakers dwelt on the close and splendid harmony with which the association is working.

The Use of Ozone in Residence Heating

By E. S. Hallett

Chief Engineer, St. Louis Board of Education.

(From a paper presented to the National Warm Air Heating and Ventilating Association, in Cleveland, O., April 16, 1925.)

WHAT has been done in ridding the world of the diseases carried by water and impure food has not been done for the air that we breathe, although the importance of the last is greater than that of either water or food. The respiratory function is the critical one of our lives. We may live perhaps four weeks without food; about four days without water and possibly four minutes without air or oxygen.

It is of utmost importance to the public to know that there is no such thing in large cities as fresh air or pure air outside of buildings.

The open-air school and the open sleeping porch in the midst of the city are the result of completely mistaken notions of the air conditions. The attempt to get better air conditions in the city is a most commendable move, but up to the present time there has been a very meager provision for supplying that want in the homes.

The basic thought in the development of better ventilation has been to secure the most perfect natural air condition that can be found anywhere in the great "outdoors," and reproduce it in our buildings.

The day has passed when simply a uniform temperature is sufficient or satisfactory. We have reached the point where we now actually reproduce the characteristics of the mountain air. The plain duty of the heating and ventilating engineer is to reproduce in the simplest and surest manner the air conditions of outdoor nature. These are briefly: controlled temperature; air motion without drafts, humidity at 40% to 60% of saturation; dust removal, and ozone for removal of odors and the production of the normal outdoor tonic.

The discovery of practical means of using ozone in ventilation has been a great forward step when considerations of health and comfort are controlling factors. Much of the story of the use of ozone in the St. Louis schools has been written but the greatest and best part of it can never be adequately told. About seventy thousand children in St. Louis are daily enjoying the benefits of ozone.

After six years of continuous use of ozone in the O'Fallon School, the first with which it was tried, the principal and teachers are as enthusiastic as ever. They all agree that ozone prevents fatigue and produces a great improvement in the health and attendance of the pupils. It was early noticed that ozone increased the weight of both pupils and teachers.

OZONE NECESSARY FOR RESIDENCES

Regarding ozone in the residence—a strange notice seems to prevail that ozone is for purifying crowded, and bad smelling places only. That is not true. Ozone is necessary for all ventilation, and our homes are the most important places to be ventilated.

In St. Louis, all the new schools built within the past five years ozone has been a part of the regular equipment and at this time about 70 large schools have been so equipped, so that more than seventy thousands persons are enjoying the benefits of ozone. Dr. Starkloff of the City Health Department has reported that in the past five years the deaths from tuberculosis have been reduced to less than half of the former number. Just recently he reports that the past year was the first in the history of St. Louis when the number of cases of all the serious diseases has been reduced. There has been no important health measure in the city except the use of ozone in the schools and some industrial ventilation with ozone that could have an effect upon vital statistics.

A sample experience with the Pestalozzi School will help to appreciate the fact that the improved health of the school children has affected the totals and averages of the whole population. Three years ago ozone was installed in the Pestalozzi School which is a down town old school crowded to the limit. Mr. Steuber the principal, asked the Hygiene Department to weigh the children monthly and these weights compared with average normal weights of the respective ages. At the beginning this school had more than 30% of pupils under normal weight and after four months the test showed that this subnormal weight affected but 14%. No other change had been made.

It is up to us now to make the proper application to the residence. Of the five important functions of heating a residence, regulated temperature is first and ozone second. It is impossible to write into a paper an adequate idea of the comfort that attends an ozonized home.

The installation of ozone should not be left until all the heating conditions are ideal for it is very simply installed in the recirculating duct or in any portion that carries air to all the house. Provision is now made in the apparatus for control which should run up into the house for convenience. Ozone in ventilation should not produce an odor. It is best regulated so as to be just below the ozone odor which is something less than one part of ozone in a million of air. At this concentration the air has a feeling of freshness and exhilaration not produced by any other means. The relief from colds and coughs is very pronounced. The increase in appetite and weight is very general.

The need of today is for a simple air conditioning heating plant in the basement that shall operate automatically and reliably and deliver this conditioned air to the house. There is no doubt going to be a demand for gravity circulated and recirculated warm air heaters which will have air washers or filters and ozone, and for a complete fan heater which shall be positive and perfect. The small cost of the fan and the electric power to operate it are easily within the limits of house heating for modest homes.

It is hoped that the methods used in handling and treating air in large quantities may be utilized and adopted for the home; that architects of residences may recognize their responsibility in house plans for the new type of heating and ventilation, and that the humble home may enjoy purified and healing air as restored by the use of artificial ozone.

Proposed New Radiator Valve Standards

In addition to the standard dimension for radiator valves proposed by the Committee on Standardization of the Heating and Piping Contractors National Association, and adopted by this organization over a year ago, the committee has now agreed upon the following additional dimensions which will be submitted for action at the forthcoming convention of the Heating and Piping Contractors National Association in Detroit, Mich., June 1-3.

1. That the following dimensions, center-of-valve to face-of-outlet, be adopted as standard:

½-in. valves 2¼ in.
¾-in. valves, 2¾ in.
1 -in. valves, 3 in.
1¼-in. valves, 3½ in.
1½-in. valves 3¾ in.
2 -in. valves, 4¼ in.

2. That said standard dimensions also apply to union elbows.

3. That said standard dimensions apply to modulating valves, *with the exception of the ½-in. size*, on which the dimension should be 2¾ in.; in other words, the same as applies to the ¾-in. valve.

4. That a tolerance of plus or minus be allowed of ⅛ in.

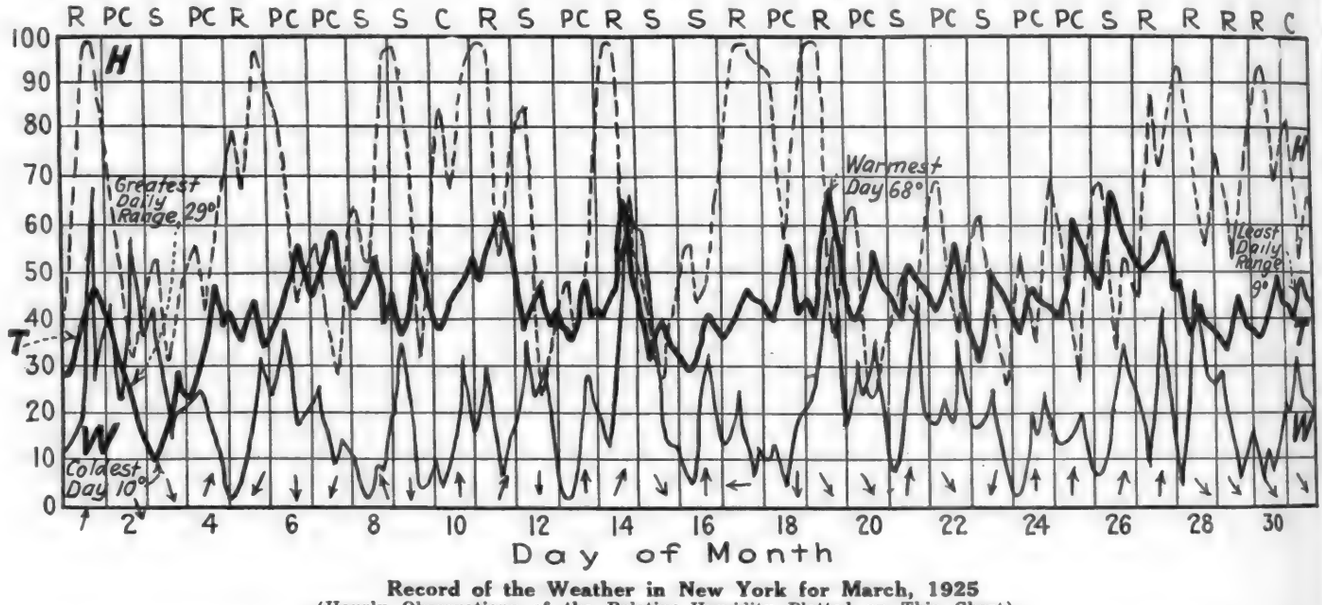
5. That the same become effective January 1, 1926.

The standard dimensions already adopted is as follows:

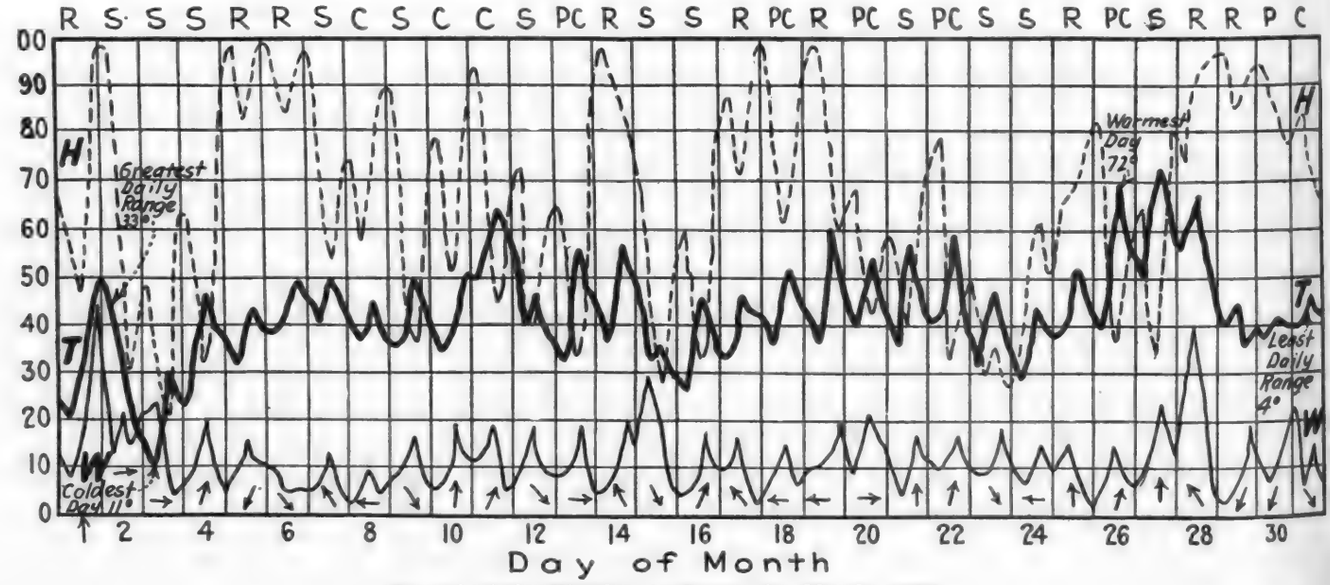
3¼ in. as the center-of-valve to face-of-inlet spud for ½-in. return-line vacuum valves.

The Weather for March, 1925

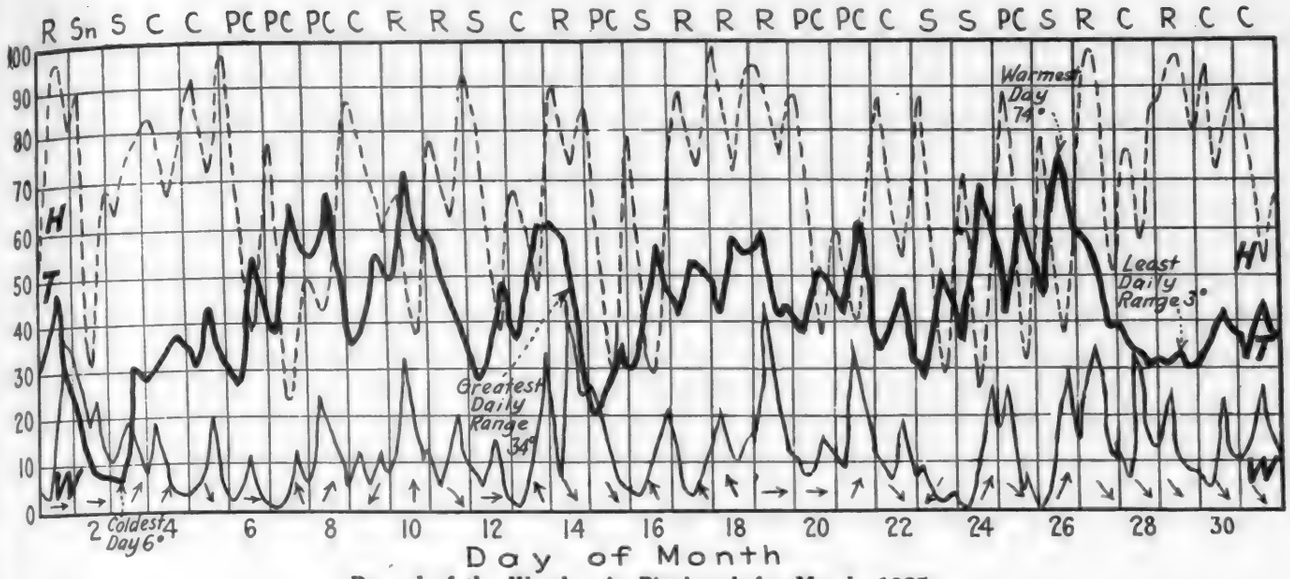
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	68	72	74	76	81
Date of highest temperature	19	27	26	26	24
Lowest temperature, deg. F.	10	11	6	—1	7
Date of lowest temperature	3	3	3	2	2
Greatest daily range, deg. F.	29	33	34	31	37
Date of greatest daily range	2	2	14	25	9
Least daily range, deg. F.	9	4	3	5	9
Date of least daily range	31	30	29	8	11
Mean temperature for month, deg. F.	43.6	43.0	42.4	39.7	48.6
Normal mean temperature for month, deg. F.	37.7	35.6	39.6	36.3	44.2
Total precipitation, in.	3.25	5.21	1.61	1.51	1.50
Total snowfall, in.	Trace	Trace	0.5	3.1	Trace
Normal precipitation, this month, in.	4.10	4.08	3.01	2.55	3.43
Total wind movement for month, miles	14037	7364	85560	10045	10552
Average wind velocity, miles per hour	18.9	9.9	11.5	13.5	14.2
Prevailing direction of wind	N. W.	N. W.	N. W.	S.	S.
Number of clear days	9	12	5	10	17
Number of partly cloudy days	11	7	6	12	10
Number of cloudy days	11	12	20	9	4
Number of days with precipitation	12	12	11	7	7
Number of days with snow	1	1	1	3	1
Snow on ground at end of month, in.	None	None	None	None	None



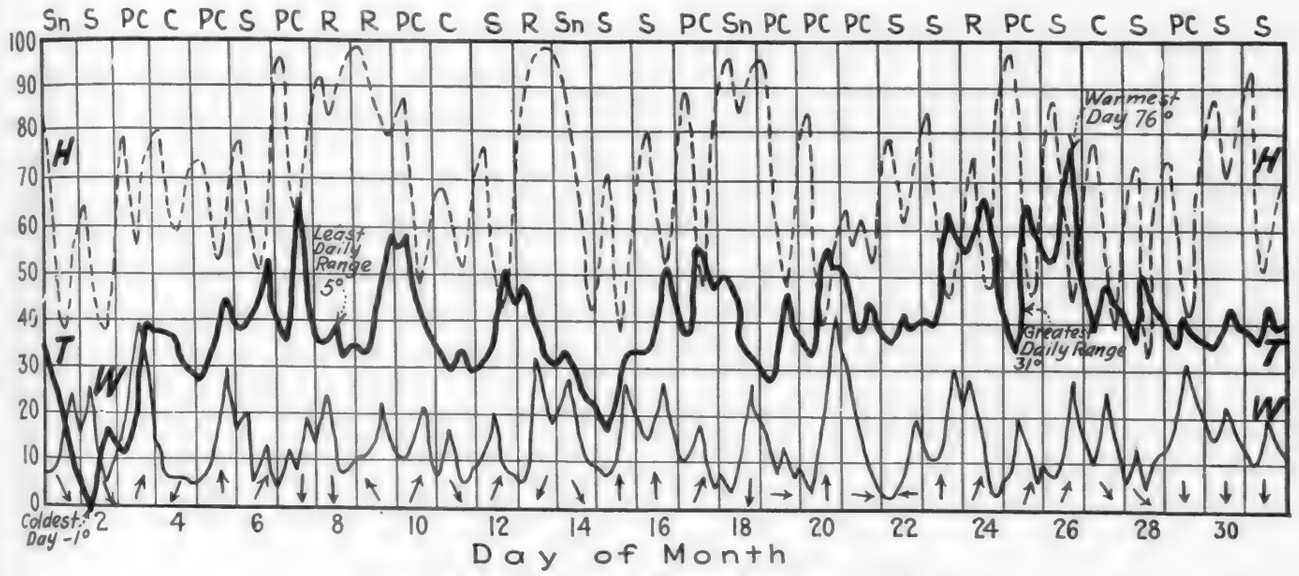
Record of the Weather in New York for March, 1925
(Hourly Observations of the Relative Humidity Plotted on This Chart)



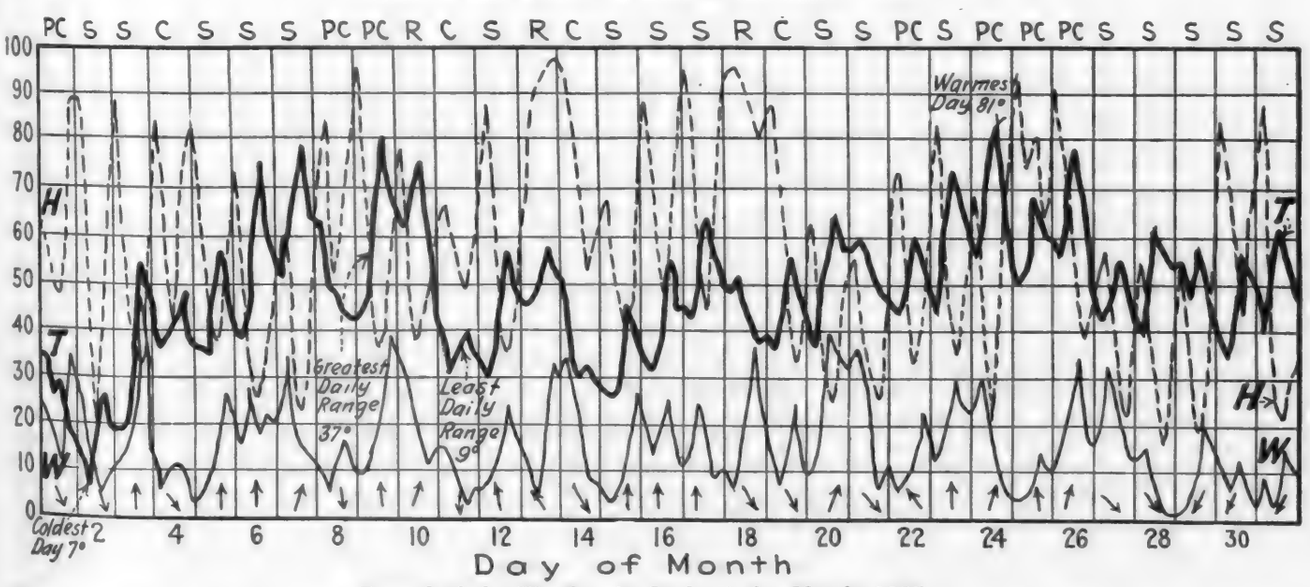
Record of the Weather in Boston for March, 1925


R Sn S C C PC PC PC C R R S C R PC S R R R PC PC C S S PC S R C R C C
Warmest Day 74°
Least Daily Range 3°
Greatest Daily Range 34°
Coldest Day 6°
Day of Month

Record of the Weather in Pittsburgh for March, 1925


Sn S PC C PC S PC R R PC C S R Sn S S PC Sn PC PC PC S S R PC S C S PC S S
Warmest Day 76°
Least Daily Range 5°
Greatest Daily Range 31°
Coldest Day -1°
Day of Month

Record of the Weather in Chicago for March, 1925


PC S S C S S S PC PC R C S R C S S S R C S S PC S PC PC PC S S S S S
Warmest Day 81°
Greatest Daily Range 37°
Least Daily Range 9°
Coldest Day 7°
Day of Month

Record of the Weather in St. Louis for March, 1925

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F. Light Lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow. Arrows fly with prevailing directions of wind.

Wisconsin's Revised Heating and Ventilation Code

Full Text of the Latest State Law Covering Standards for Heating and Ventilation of Public Buildings and Places of Employment

(*Adopted April* 8, 1925)

Introduction

DURING the past several years general requirements on ventilation of public buildings and places of employment in Wisconsin have been enforced as part of the Building Code and of the General Orders on Sanitation, issued by the Industrial Commission. The Building Code became effective on September 15, 1914, and the ventilation requirements therein were amended only in minor details prior to July 6, 1923.

The General Orders on Sanitation became effective on February 20, 1913. The ventilation requirements contained therein, Orders 2000 to 2017, inclusive, were amended in 1921, effective July 19, 1921. The revised general ventilation requirements, contained in Orders 2000, 2010, 2011, 2012 and 2020 to 2025, inclusive, are still in force as applied to all places of employment. These requirements have been reprinted in the Appendix to this Code.

In the Fall of 1922, the Industrial Commission appointed an advisory committee to assist in the preparation of a reasonable code of standards of heating and ventilation for public buildings and places of employment in Wisconsin. The personnel of this committee is as follows:

C. E. Bronson, Kewanee, Ill., representing the American Boiler Manufacturers' Association.

Dr. H. E. Dearholt, Milwaukee, Wis., representing the Wisconsin Anti-Tuberculosis Association.

G. J. DeGelleke, Milwaukee, Wis., representing the Wisconsin Chapter, American Institute of Architects.

Henry Hotten, Milwaukee, Wis., representing the National Boiler and Radiator Manufacturers' Association.

Prof. G. L. Larson, College of Engineering, University of Wisconsin, Madison, Wis.

Samuel R. Lewis, consulting engineer, Chicago, Ill.

*Len F. Sargent, Wausau, Wis., National Heating and Ventilating Company.

H. W. Schmidt, Madison, Wis., State Department of Public Instruction.

E. Worthing, Milwaukee, Wis., President, Bayley Manufacturing Company.

**R. A. Small, Madison, Wis., ventilating engineer, Industrial Commission.

W. C. Muehlstein, Madison, Wis., building engineer, Industrial Commission.

*Appointed following death of H. L. Williams, Milwaukee, American Foundry and Furnace Company, who was a member of the original committee.

**Resigned. September 30, 1924.

The Heating and Ventilation Code Advisory Committee met regularly, averaging two meetings per month, for the purpose of preparing a heating and ventilation code. The work of the committee was submitted to the public for criticisms and suggestions in public hearings held at Eau Claire, Oshkosh, Milwaukee and Madison, in February, 1923. The Heating and Ventilation Code, as revised by the committee on the basis of public heatings, was adopted by the Industrial Commission on July 6, 1923, and became effective August 19, 1923.

In the enforcement of this code following its adoption by the commission, it soon became evident that there was some dissatisfaction as to the reasonableness of some of the requirements. Publication was, therefore, postponed and the code was placed in the hands of the Advisory Committee for further consideration. The revised code as finally submitted to the commission, with recommendation for adoption, is the result of a conscientious effort to devise a reasonable and beneficial standard of heating and ventilation of public buildings and places of employment. This Heating and Ventilation Code was adopted by the commission on April 8, and becomes effective 30 days after official publication.

SECTION 1. DEFINITIONS

Order 5800—*Definitions.*

1. *Ventilation* is the production and maintenance of atmospheric conditions conducive to health and comfort indoors, without detrimental drafts, by means of inlets and outlets in conjunction with gravity or mechanical means of moving air.

2. A *ventilation system* is any combination of building construction, machinery, devices or equipment, so proportioned, arranged, installed, operated and maintained as to secure with normal operation the standard of ventilation required by this code.

3. A *heating system* is any combination of building construction, machinery, devices or equipment, so proportioned, arranged, installed, operated and maintained as to produce and deliver in place the required amount and character of heating service.

4. A *gravity system of ventilation* is any ventilation, the practical effectiveness of which depends wholly upon atmospheric conditions, such as relative density, temperature, or wind motion.

5. A *mechanical system of ventilation* is any ventilation, exhaust or heating system, the effectiveness of which depends upon the operation of power-driven equipment.

6. An *exhaust system of ventilation* is any combination of building construction, machinery, devices, or equipment, so proportioned, arranged, maintained and operated, that noxious gases, dusts, fumes, vapors, vitiated air, or other materials injurious to health, are effectively withdrawn from the breathing zone of employes and frequenters.

7. *Air supply* is the supply and appropriate distribution and disposal of the air required for ventilation.

8. *Fresh air* is air that is stimulating and refreshing and which is free from contamination of any kind in proportions detrimental to the health or comfort of the persons exposed to it.

9. The *fresh air intake* includes the ducts and out-door openings through which outside air is admitted to a ventilation or heating system.

10. An *inlet* is a duct terminal or an opening in a room through which the air supply enters the room, and shall be understood to mean and include only those inlets which are definitely and specifically provided for such purposes.

11. An *outlet* is a duct entrance, or an opening from a room through which the vitiated air leaves the room, and shall be understood to mean and include only those outlets which are definitely and specifically provided for such purposes.

12. A *duct* is any pipe, flue, channel or housing, used or intended to be used, for the conveyance of air, gases or entrained materials pertaining to a

heating or a ventilation system. An underground duct is any duct wholly or in part below the surface of the ground adjacent to the duct.

13. *Out-door openings* are those openings in outside walls which are arranged and equipped in such manner as to be easily operated and accessible for manipulation.

14. The term *heating surface* applied to boilers, shall be understood to mean and include the total wetted area between grate line and normal water-line, exposed to combustion of fuel or in intimate contact with flowing combustion gases on one side and water on the other side.

The term *heating surface* applied to furnaces and stoves, shall be understood to mean and include only the total area of air supply surface between grate line and smoke collar, exposed to combustion gases on one side and flowing air supply on the other side.

15. An *occupied area* is any room, area or enclosure, the normal use of which involves actual or intended occupancy by one or more persons.

16. The term *existing building* used in this code shall be understood to mean and include buildings, additions thereto, and alterations thereof, structurally completed, or for which complete plans have been approved by the Industrial Commission, or its authorized local representative, and construction is in progress, prior to effective date of this code.

17. The term *new building* used in this code shall be understood to mean and include buildings, additions thereto, and alterations thereof, for which complete plans have not been approved by the Industrial Commission, or construction is not in progress, prior to the effective date of this code.

SECTION 2. SCOPE OF HEATING AND VENTILATING CODE

Order 5810—Scope of Code.

1. Public Buildings and Places of Employment. The provisions of this code shall apply to all buildings used, or to be used, as places of employment or as public buildings, as defined by statutes.

2. New Buildings. The provisions of this code shall apply to the heating and to the ventilation of all new buildings.

3. Existing Buildings. The provisions of this code shall apply to all necessary alterations or improvements in existing buildings, other than existing places of industrial employment.

4. Change in Use. The provisions of this code shall apply to every building, or portion of a building, devoted to new use for which the requirements under this code are in any way more stringent than the requirements covering the previous use.

SECTION 3. GENERAL REQUIREMENTS

Order 5820—Plans, Specifications and Data.

1. Design and Preparation of Plans. All plans and data for heating and for ventilation shall be designed and prepared by competent designers.

2. Approval of Plans and Specifications. Complete plans for heating and for ventilation, together with the specfications applying to contracts for the work involved, for all theatres, assembly halls, schools, colleges, academies, apartment houses, hotels, and places of detention, and for all factories, office and mercantile buildings, having floor or roof spans greater than 30 ft., or which are more than two stories high, or which are two stories high and are more than 5000 sq. ft. in floor area at the second floor level, shall be submitted to the Industrial Commission for approval. (In cities where plans are examined, and building permits are issued, in a manner approved by the Industrial Commission, this requirement does not apply.) Approval shall be obtained before affected work is commenced.

(To be continued)

Changes Incorporated in the New Code

By W. C. Muehlstein

Building Engineer, Industrial Commission of Wisconsin

CHANGES which have been incorporated in the new code are as follows:

1. Elimination of the previous limitation in amount of direct radiation in split systems of heating and ventilation.

2. Requirement for constant speed fan drive removed from the code.

3. Elimination of general engineering data so far as possible.

4. In general, requirements for insuring tempered fresh air during occupancy, that is, to fool-proof a system, were removed. As the code now reads, methods of installation to insure operation of ventilation system at all times during occupancy are encouraged in various ways but the designer is not restricted in his methods for obtaining results called for.

5. The aim of the code as now written is to specify results without limiting methods of design.

The Heating and Ventilating Code is enforced as a part of the other building regulations issued by the Industrial Commission. The Building Code has been in effect since September, 1914. In the beginning the Building Code was in the hands of one man, so that enforcement was necessarily educational. Since then, through the extension of educational policy, enforcement has been extended so that now five men in the building department of the Industrial Commission enforce building regulations by:—

1. Requiring submission of plans and specifications for public buildings and places of employment for approval.

2. Inspection of all new construction work in progress to check conformance with plans and the code.

3. Inspection of existing buildings to investigate status of conformance to regulations which affect them, including fire protection, fire prevention, general safety and sanitation.

4. Co-operation with city officials throughout the State, including building inspectors, fire chiefs and city engineers, architects, builders, and owners. This feature of co-operation in the interests of safe buildings and economy of construction resulting from uniformity in regulation, is the vital factor in the scheme of building regulation in Wisconsin.

Since the Heating and Ventilation Code became effective on August 19, 1923, enforcement has been more dependent upon co-operation with designers and owners than detailed check of plans and specifications and field inspection. Plans and specifications and data sheets are required to be submitted for approval, but during the transition period between the enforcement of the very brief and general requirements previously contained in the State Building Code and the present more complete Heating and Ventilation Code, it has been the policy to check plans and specifications only in so far as it was necessary to determine compliance with the code in the main features and the general scheme, relying upon the responsibility of the designer for compliance with the Code in detail. Exactly the same policy which was used in the enforcement of the State Building Code in its early stages will be applied in the enforcement of the Heating and Ventilation Code.

At present the enforcement of the Heating and Ventilation Code is working out very satisfactorily. The present requirements meet with the general approval of designers and the public, as indicated by the nature of the plans which are submitted for approval and the installation of heating and ventilation plants installed. The general compliance with the operation requirements of the code cannot yet be determined, as this requires continuous observation of jobs in the field, which will be done by the Industrial Commission in co-operation with other departments of the State, including the Department of Public Instruction and the State Board of Health. With the elimination of fool-proofing requirements of the code the enforcement of the code must be dependent upon co-operation of all parties concerned.

Mechanical Ventilation Wins Out in Ohio

Addresses at Convention of Sheet Metal Contractors' Association of Ohio Which Helped Defeat the Proposed Change in the Ohio State Building Code Lowering the Ventilation Requirements in School Buildings

IN view of the fact that the proposed changes in the Ohio State Building code regarding the ventilation requirements for school buildings were finally defeated when the matter came to a vote, special interest attaches to the proceedings on this subject at the annual convention of the Sheet Metal Contractors Association of Ohio, in Cleveland, February 25.

The principal speaker was Frederick R. Still, vice-president of the American Blower Company. His address gained added significance from the fact that he devoted a portion of his remarks to the recent agitation in Ohio for a revision of the Ohio State building code involving a reduction in the ventilation requirements from 30 cu. ft. of air per minute, per pupil, to 10 cu. ft. Mr. Still said in part:

"Air motion over the individual plays a most important part in the satisfaction obtained; but how are you going to get air motion over the entire area of a school room unless a sufficiently large column of air is delivered to accomplish it? It can't be done with 5 cu. ft. per minute; and we haven't learned how to do it with less than 20 cu. ft. per minute per person, and about the least that should be attempted in school buildings is 30 cu. ft. If individual nozzles were located on the tops of the desks, so designed that they would blow directly into the faces of the pupils, the same thing might be accomplished with perhaps 10 cu. ft. per person per minute. Thus it will be seen that there are some practical mechanical difficulties to be considered as well as merely theoretical standards.

"These statements are not visionary. Raising the relative humidity to about twice what is normally found in the average school in cold weather, will permit the dry-bulb temperature to be lowered from 4° to 6°, as compared with the usual school temperature. If, in addition, the air is so distributed that an air motion of from 50 to 100 ft. per minute prevails all over the room, and all odors are eliminated, then an approximation of the same exhilaration will be obtained indoors as felt outdoors in the finest weather. This can and is being done to-day.

"We are satisfied that 5 cu. ft. of outdoor air, mixed with 25 cu. ft. of circulated air, all of which is passed through a properly designed air washer, will give as highly satisfactory results as any one could desire,-and thereby save from 40% to 60% of the heat usually used by any system of ventilation anybody can name. Nobody has had the audacity, as yet, to try recirculating more than 75% of the air in school buildings, but that amount has been recirculated in several schools in two large cities. It has *not* been made public for fear of criticism, but after three winters in one city and two in the other, no differences can be observed in the effect it has on the pupils, when compared with those in schools where none of the air is recirculated. The observable results in the rooms are equally comparable in every respect with any other schools.

WINDOWS CAN BE OPENED WITH MECHANICAL VENTILATION

"We never have advocated keeping the windows closed, so long as no discomfort results from opening them, due to drafts, chilling the room, or causing a waste of fuel. We *have* maintained that it is unnecessary to open the windows, if the ventilating plant is properly designed and operated, and that it is wasteful to open them, but we never said it could *not* be done; neither have we ever claimed that it would upset the ventilation of the other rooms, if the windows in another room were opened.

"Most modern schools have independent ducts leading from a plenum chamber to each of the rooms. Wherever such a system is installed, there can be no effect in the other rooms if the windows are opened in any one of them. If the air is distributed by a trunk line system, with branches from it to the various rooms, there may be some effect, but what will it amount to? If the windows are opened in a room on the windward side of the building it may check the flow of air from the duct into that room, but as much more will come in through the window, so *that* particular room will get its full supply. The pressure from the wind on that side will then cause more air to flow into the other rooms because of the increased static pressure in the duct, hence those rooms will get more air if anything than it was originally calculated they should receive.

DISADVANTAGE OF SPLIT SYSTEMS

"Another common point of attack is the lamentable fact that the fans are only operated a few hours of the school session, and in many instances they are not operated at all. The same is also claimed with full warrant for such claims, about the air washers. There are several reasons for this:

"1. It has become quite the common practice for consulting engineers to install enough direct radiation to heat the entire building in the most severe weather, simply relying on the fans for circulating the air for ventilation and applying only so much indirect radiation as will warm the air from the outside temperature to the temperature of the room. This is a mistake, considered from any angle you may view it, and particularly from the point of initial cost and economic operation, as well as the difficulty encountered in supervision.

"No more direct radiation should be installed than is necessary to keep the building from freezing when the fans are not operating. The building should be heated and ventilated by the blower system alone. This will materially reduce the first cost and if 50% to 75% of the air is recirculated, the operating cost will be little if any more than with direct radiation and will cost far less to operate than with any other system we know of.

"2. Because air washers are not operated in schools is not an argument against their effectiveness. It is an indication of poor management of the engineers or janitors, who are too lazy or indifferent to take care of them. If the air washers collect dirt to an extent that they need frequent or even occasional cleaning, that is striking evidence of their absolute necessity. If they did not catch it, the dirt would lodge somewhere else or pass into the building. Dirt can be removed by filters made of cloth, metal, screens, oil films, etc. All of them require frequent cleaning and vastly greater attention than an air washer and none of them will humidify the air.

"3. Humidification can be accomplished in many ways but none has been found that will humidify, cleanse the air and eliminate odors, all at the same time, with equal efficiency and do it noiselessly and inexpensively to the same extent that an air washer will. An air washer never clogs up: if the tank is kept reasonably clean it always functions properly. Any other device is far more difficult to clean, some being almost impossible to clean, and all others need more frequent cleaning to prevent them clogging up and sometimes they clog to such an extent that they become a serious hindrance to the air flow.

"4. If the required heat can only be obtained by operating the fans and the air washers are kept clean, then the whole argument against the central system from these two standpoints breaks down. It is not the system itself, but the way it is sometimes designed and the lack of competent supervision that should be convicted.

"5. Many engineers or janitors receive credit ratings for the economical operation of the steam plant of which they have charge, and their future advancement hinges on the showing they can make in the coal saved, as well as other supplies. They know that they will burn more coal when the fans are running than when they are idle. Hence they are prone to keep them shut down, or else running at very slow speed. There is another 'kick' in this idea too; they don't have to work so hard, but they don't mention that very often.

"If a check has to be maintained to keep down the cost of operation, a system should be instituted which gives the janitor credit for efficient operation and penalization for deficiencies, instead of a system that tends to destroy all initiative, as is so common in most of the schools.

"We know a school in Brooklyn, having two fans that have never had a belt on them since they were installed, several years ago. Inquiring of the custodian why he did not report the condition, he replied that it was none of his affair; if he had to run the fans he would have more to attend to and his credit for economical operation would be lowered because he would burn more coal. This is but a fair sample of many others.

"It is the modern idea to prevent sickness and disease. As applied to children, it is laying a foundation for the future health and welfare of the nation. It tends to eliminate paupers, mental defectives and criminals. Even if a modern central ventilating plant does cost more than some others, it costs the taxpayer less in the end than to build and maintain suitable institutions for the care of the physical and mental defectives resulting from unsanitary conditions and bad ventilation. This is something we can't escape, and we all should face the matter in a calm way, inform ourselves thoroughly so as to be ready to meet the issue, and then work for our convictions."

THE MECHANICS OF OPEN WINDOWS WITH FAN SYSTEMS

Another speaker was A. A. Criqui, chief engineer of the Buffalo Forge Company, who spoke particularly of the effect on the mechanical ventilating systems of opening doors or windows. "One of the objections," he said, "that is usually advanced against fan systems is that if a couple of windows are open in a class-room that room will immediately rob the other rooms of their proper portion of air.

"This may have been true to a certain extent in systems designed many years ago, but in the modern designs of central ventilating systems with main trunk lines, it can be proven by figures and by tests that this system will operate more uniformly than any unit system so far devised.

"Let us see if it is true that an open window in one room can rob the remaining rooms of their proper supply.

"Let us assume that we have a school with ten class-rooms, each of which should have an air supply of 1000 cu. ft. per minute, and that a central system with one main trunk supply duct is installed. Our method of design in such a case is to have a volume regulating damper in each branch duct near the main, and this damper is set so as to create a resistance of at least 0.1 in. in the branch. In other words, the resistance of the branch, plus the damper, will be at least 0.1 in. The static pressure in the main duct at the last branch, for instance, will be 0.1 in., and the first branch or the one nearest the fan may be 0.15 in., the 0.05 in. difference being the resistance in the main duct between the two branches.

"When the system is put in operation the dampers are all adjusted and set so that each room received 1000 cu. ft. A.P.M.

"The static pressure actually created in a class-room receiving its normal supply and having the usual vent or exhaust opening will average about 0.01 in.

"The speaker has made tests of this pressure in many different rooms in different schools, and in no case did the pressure exceed 0.01 in., and in most cases it was less than this amount.

"Suppose, then, that after our school is in operation several windows are opened in one room and the pressure in this room of 0.01 in. is reduced to zero. The air flow to this room is caused by the differences in pressure between the air in main duct and the pressure in the room itself, and the volume of flow is governed by the resistance of the branch.

"In our case the pressure in the duct is 0.11 in. (0.1 in. for branch resistance and 0.01 in. for static in room), and room pressure is 0.01 in., so that the air flow for (0.11 in.—0.01 in.) or 0.1 in. will be 1000 cu. ft. per room, and if the room static is reduced to zero the pressure differences between duct and room will be 0.11 in. The branch supplying this room will then deliver more air until the 0.11 in. pressure is used up in branch resistance. As we all know, the resistance of a given orifice or duct varies as the square of the velocity. The air flow will increase as

$$\sqrt{\frac{0.11}{0.10}} = 1.05.$$

"The air flow in this room will then increase 5% over the required volume, and if this extra volume would be taken from all of the other rooms, each room would lose about one-half of 1% of its normal air supply. However, as a matter of fact, the present day multiblade fans have a great capacity range, and the additional 5% delivered to one room, which is but one-half of 1% additional total capacity, would create no measurable reduction in pressure in the main duct, so that the other nine rooms would receive more than the 99-1/2% of their required supply.

UNIT VENTILATOR OPERATION

"On the other hand, now let us consider the operation of the unit type of ventilating apparatus. These units are placed on the outside walls on all sides of the building, and take the fresh air directly through an opening in the wall.

"Let us assume that these units are all tested and set for the required air on a calm day when there is no wind blowing outside. Whenever there is a wind blowing, it will blow directly into the inlets of some of the units and will very materially change the air delivery of such units. These units operate at a pressure somewhere around 1/4 in. static, and the velocity pressure created by the wind at different velocities is as follows:

A 15-mile wind equals 1320 feet minute velocity and 0.11 in. velocity pressure
A 30-mile wind equals 2840 ft. minute velocity and 0.44 in. velocity pressure
A 45-mile wind equals 3960 ft. minute velocity and 0.98 in. velocity pressure
A 60-mile wind equals 5280 ft. minute velocity and 1.74 in. velocity pressure

"Considering the wind effect on the units, which will vary anywhere from zero velocity to 60 miles an hour from day to day, and on any one day the wind effect will be different on the various sides of the building, it is evident that this pressure will have a seriously disturbing effect on the performance of the units.

"The claim is made for the unit ventilator that when a high wind is blowing on one side of the building, a pressure is automatically built up in the room that will overcome and prevent infiltration.

"Take, for instance, a 60-mile an hour wind. This is a velocity of 5280 ft. per minute, and a velocity pressure of 1.74 in. The pressure in the room depends, not on the amount of air delivered to the room, but on the resistance of the flue or duct through which the air escapes from the room. The pressure will be about 0.01 in. in a class-room receiving its normal supply of air. When a high wind blows directly into the inlet of a unit, it will unquestionably increase the air delivery of this unit to an amount depending on the velocity of the wind and the pressure characteristic of the fan in the unit. Let us say that a high wind will increase the velocity through the unit 50%. As the resistance of the exhaust flue varies as the square of air delivered, the pressure in the room will rise from 0.01 to

0.0225 in. This 0.0225 in. will certainly be so far below the outside wind pressure that it will be of no practical use in preventing infiltration. But the fact that the unit delivers 50% more air than it should is a serious matter, as this additional air must be heated to room temperature, and therefore requires additional steam."

During the discussion of these two papers Mr. Lamneck of Columbus referred to the movement to revise the Ohio State Building Code, including the section on ventilation. This proposed change, he held, involving a reduction in the air requirements in school buildings from 30 cu. ft. of air per minute, per pupil, to 10 cu. ft., was being agitated in the interest of the manufacturers of unit heaters.

He then presented a resolution which was unanimously adopted by the association, placing the association on record as opposed to the change in the State Building Code reducing the air requirements either in a school, church or assembly hall.

HEATING AND VENTILATING PLANTS TOO ELABORATE

Before the resolution was adopted Mr. Still again addressed the meeting.

"One of the things that leads to a tax on ventilation," he declared, "is that engineers have been committing suicide on this thing by elaborating plans to an extent that makes them altogether too costly. And the plants are too costly to operate, too. The cost of the ventilating systems is piling up, piling up, as you know, year after year. Some years ago they used to put in heating and ventilating plants for less than $5,000. You can't now get it done for $17,000 in the same-sized school. That is one of the issues.

"When they arbitrarily undertake to say that so many cubic feet of air per minute should be delivered into a school building they are doing something that is just as bad as what was mentioned by one of the speakers a little while ago about the code as it has been standing. Who is responsible for it?

"The American Society of Heating and Ventilating Engineers has wrestled with this for a long time. The issue has been put up to the society time after time, to establish a code the States could use.

"The lack of something that definitely describes what is ventilation has been one of the great stumbling blocks and we are working on this problem and have evolved something that is a yard stick, by which you can assure results; namely, the Synthetic Air Chart. This is a yard stick by which good ventilation can be measured, and the society has taken a stand that the average of the seven elements that enter into a ventilating plant must come to 98% in a school building.

"Now if the State of Ohio wants to get somthing definite in school ventilation, and it wants to determine if it is getting it, then have a law so worded that all the various developments coming along in new methods of ventilation, no matter what they may be, either furnaces, indirect, or direct radiation, gravity systems, blowers, or whatever it may be (we are living in an age of improvement all the time, and it may be that somebody will develop something whereby you can put in an oxygen machine and thereby never have to move ony air; you can't tell), but if that time comes, they want a yard stick to determine whether by putting an oxygen machine in the room it is giving them what the human system requires, and that they are getting 98% results on the Synthetic Air Chart."

HIGH COST OF SCHOOL BUILDINGS CAUSE OF AGITATION TO CHANGE CODE

Before the vote was taken on the resolution the subject was further discussed by Director of Schools Frank G. Hogan of Cleveland. During Mr. Hogan's connection with the Cleveland public schools, the school population has grown from 62,000 to 140,000. "There has been constructed," he said, "during the time of my employment with the board, the difference between 60 school plants, and possibly 133 school plants. The school organization of Cleveland is directly interested in the matter of certain changes in the State Building Code, but not in the reduction of the ventilation requirements." He expressed his endorsement of the resolution.

Another speaker was Mr. McCornack, architect of the Cleveland public schools. Mr. McCornack said that he spoke for the State Association of Architects which is back of most of the proposed amendments of the State Code.

"The situation in this State," he stated, "in my opinion has reached a dangerous phase, and if we want to save the State code and not have it entirely obliterated some changes are necessary. I think Mr. Still hit the nail on the head when he touched on the point that there is an aroused public sentiment on the question of ventilation that is just like a mob feeling. People will act contrary to common sense or anything else to get rid of a code that is being imposed upon them, involving ventilation and other mechanical equipment. It must remembered that 25% of the total sum spent on school buildings in the past has been spent on the mechanical equipment.

"We have made certain studies throughout the State and have presented them to the State Board of Building Standards of Ohio. There are other things than the ventilation requirements which are undoubtedly higher than they should be. There are certain restrictions of the sizes of rooms which force our buildings to be constructed much larger in cube than necessary.

"It is our opinion, and we have the figures to back it, that with the State Board Code changes we are proposing we can cut 10% from the cost of the buildings. The question of the reduction of the air supply from 30 cu. ft. to 10 or 5 cu. ft. per minute, per pupil, is something, I confess, more or less of a mystery to me. When you face a layman with the fact that he breathes only 18 cu. ft. of air per hour he wants to know why you put in 1200 cu. ft. I admit that there are some questions baffling to the layman.

"I am not in favor of open-window ventilation. We have to have some kind of mechanical ventilation in the building. As far as the sheet metal contractors business is concerned it seems to me that with a slight lowering of the building code requirements we are going to increase the volume of business. There are buildings that should be razed, and new buildings put up in their places.

"The architects are faced constantly by the Board of Education and laymen who are attacking them because they are erecting expensive buildings, accusing them even of connivance with contractors.

"The resume we made of the State codes of the United States five years ago showed Ohio to be in a class by itself as regards stringent requirements in connection with all kinds of construction. A committee of the American Institute of Architects is now working on a proposed code which can be adapted to the needs in different sections. It does not, however, cover ventilation. We are not touching on ventilation because we feel we know very little about it.

"As regards the proposed changes in the Ohio code. I want to urge you to support the amendments which are reasonable and just, and you will find the architects of the State will go along with you on the terms 'reasonable and just,' and will try to determine reasonable and just requirements for everything that should go into a school building.

"You can approach the officers of the State organziation or the Cleveland Chapter or any chapter in the State, and you will find the architects are definitely of the opinion that costs must be reduced, even in spite of the fact that such a procedure would reduce the architects' commissions. Prices are so high in the large cities of the State that it is reasonable to expect us to work for a reduction in cost. Of course this is not a bankrupt country, by a long shot, but there are many improvements that should be included in buildings together with means for eliminating the smoke nuisance and similar appliances, all of which come from the taxpayers and it is up to us to reduce building costs wherever we can.

"I want to say for the officers of the State Association of Architects and for the members of the various committees,

that we will be glad to meet with a committee from your organization and discuss frankly the question of ventilation or any other subject in which you are interested."

The vote on the resolution followed immediately after the conclusion of Mr. McCornack's discussion, the vote being unanimously in favor of its adoption.

The Weather of February and March and Its Relation to the Tornadoes in Southern Illinois

MARCH, 1925, will long be remembered as the time of the destructive tornadoes in the Middle West. Year after year the people of the East recall the great blizzard of March 12, 1888, when from 2 to 5 ft. of snow covered most of the country from and including Maryland to northern New York and Vermont. Steam and surface railways were then suspended for several days. Instances are recorded wherein men, who started to their accustomed work that morning, never reached their destination nor returned home alive. But the total number of deaths was relatively few. Business of all kinds, merely because of suspension, which was quite extended in some cities including New York and Philadelphia, suffered tremendous loss.

The tornadoes of March 18, this year, not only caused loss by suspension of business activities, but a loss of life unequalled in the annals of American meteorological history, excepting "February 19, 1884, when 57 tornadoes in the same day killed about 1200 people, injured about 3000, and wrecked about $35,000,000 of property." The tornadoes of March 18, according to latest count, caused the death of 830, injury to about 3000, and property damage about $18,000,000.

It is not the purpose here to relate details of the twister's modus operandi in any particular locality. Tornadoes have been described in these columns in the scientific terms that apply to their formation, their passage and escape. They are peculiar to the climate of the Plains States in Spring, as hurricanes are to the South Atlantic and Gulf States in Fall. They occur sometimes singly and over a very limited tract; then again, as on this occasion, in groups over a wide-spread area.

ATMOSPHERIC CONDITIONS PRESAGING TORNADOES

An unusually warm and humid atmosphere in the morning sometimes presages their probable occurrence. Old time settlers in the West become apprehensive. Warnings issued by the U. S. Weather Bureau confirm their apprehension. But these warnings apply only to the territory over which tornadoes are likely to occur. No definite town or county can be specified. Sometimes the path pursued may include a whole village or settlement; or it may pass up the main street destroying only the buildings on either side from end to end of the town.

Airplanes might be useful on such a morning to supplement the Weather Bureau observations by bringing to the office information regarding conditions a mile or two above. Experience has shown that there are times when regular observations of temperature and humidity and wind velocities from on high will enable the forecaster to foresee the type of tornadoes that are likely to occur. Having explored these upper currents in the early morning, the aeronaut, like the inhabitant in his cellar, would seek shelter in the hangars, or beneath.

PRECAUTIONS WHICH MAY HELP REDUCE LOSS

Probably some practical knowledge of home ventilation might serve the inhabitants in the immediate path of the storm. Heed should be taken of all storm warnings. These are not intended to arouse apprehension; much less consternation. The first place of safety thought of is the cellar. Before going there, however, care should be exercised in the ventilation of the dwelling overhead. Many a plate glass front has gone crashing into the street by reason of the sudden opening, ever so little to the leeward in the rear end of a store or room in which the pressure of the air, as well as the temperature, had not been well adjusted to that outside. In these circumstances good circulation could have been obtained by lowering the sash of all windows just a little from the top.

WEATHER CONDITIONS ATTENDING MARCH TORNADOES

In studying the tornadoes of March 18 and the general conditions of weather in the interior of February and March, the following observations are to be noted:

The temperature and moisture of the atmosphere played an important part in the formation of the storm clouds, as well as the pressure. Temperature is, however, a relative quantity, dependent upon the season. Tornadoes occur more frequently in May and June than they do in March, though the March type is usually more severe. In June the temperature is approaching a summer stage of uniformity. But the normal temperature in March is so much

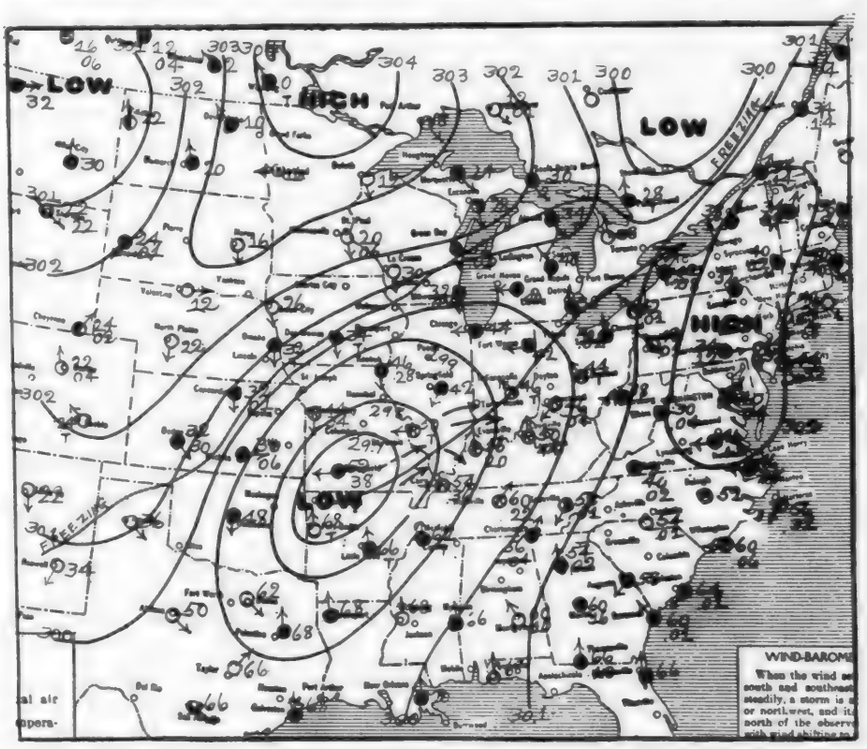


Chart of Weather Conditions in Tornado District March 18.

Published at Weather Bureau Office, New York, N. Y., 8 a. m., March 18, 1925.
Symbols indicate character of weather, clear, partly cloudy, cloudy or raining, the arrows pointing in the direction the wind is blowing. The first figures near station denote the temperature; the second the precipitation. Heavy dark lines, called isobars, surround the cyclone center.

lower than that of June, that an excess of 15° to 20° above the daily normal is a condition to be dreaded.

Except on the 1st and 2nd of March, 1925, there had been a steady accumulation of heat over the Plains States, beginning early in February. The mean temperature for February at St. Louis, Chicago, Pittsburgh and New York City approximated 6° above the daily normal. The cold-wave on March 1 and 2, though intense and wide-spread, was very fleeting. March immediately resumed the February pace of adding warmth to the earth and the incumbent atmosphere. The temperature soon got well above the freezing point. In the northwest, however, more seasonal temperatures prevailed. In northern Minnesota, the Dakotas and Montana, zero weather was reported daily from March 10 to March 15, inclusive. From Missouri northward freezing temperature was almost constant prior to the tornado date. In the general theory of atmospheric circulation these conditions indicated the presence of much cooler air in the currents well above the storm-beaten district.

In addition to the already mild temperature at the surface there was drawn into the middle Mississippi a sudden and decided increase in temperature and moisture from the Gulf. The barometer at Indianapolis fell to below 25.50 in. by 8 o'clock that evening, thereby showing that the cyclone had developed in intensity in its twelve hours' flight from Springfield, Mo. It was during this flight of the general storm center that a downward pressure of cooler air developed whirls along the much heated surface from northern Arkansas to Southern Indiana.

CONDITIONS MORE NORMAL IN WARM WEATHER

In the months of later Spring and Summer the atmospheric circulation becomes more uniform at the surface and aloft and geographically east, north and west. Cyclones then proceed across the continent with greater regularity as to circulation in the perpendicular whirl. Local storms partake more the nature of thunderstorms in which there is a tendency, in the West as in the East, to rise into the warmer air above instead of pursuing a lateral twisting movement near the surface.

In the accompanying chart the long arrow indicates the path of the storm center to Lake Ontario at 8 A. M., March 19. The small arrows show the erratic movements of storm clouds when in violent circulation of the tornado. No instrument has yet been devised for measuring wind velocity or force that can withstand the violence of this monster of storms. Its velocity is variously estimated at 150 to 500 miles per hour.

Dangers to Low-Pressure Boilers Used in Vacuum Heating Systems

VACUUM heating systems are designed on the assumption that there will always be a pressure greater than atmospheric pressure in the boiler and steam mains and it frequently appears that the designer does not stop to consider what may happen if the boilers are banked and the steam pressure allowed to drop below atmospheric pressure.

The writer was recently called on to investigate a vacuum heating system in which there had been considerable trouble from cracked boiler sections due to low water.

The system was arranged as shown in Fig. 1 and consisted of three cast-iron sectional boilers with a combined rating of about 12,000 sq. ft. of pipe coil radiation, equivalent to about 8000 sq. ft. of C.I. radiation, scattered through several buildings, a Jennings Hytor vacuum pump with receiver, and the necessary supply and return mains. The thermostatic traps used on the coils were of Sylphon type and so sensitive that they would open and close with a very small temperature difference.

It will be noted from Fig. 1 that the return main is below the receiver on the vacuum pump and that there are several lift points in the return main.

The system worked reasonably well as long as the steam gauge on the boilers showed 2 lbs. pressure or more, but as soon as the pressure in the boilers dropped below atmospheric pressure none of the condensation was returned to the boilers, even though the vacuum pump ran continuously.

An investigation was then made to find out just what happened, when the steam pressure was allowed to drop below atmospheric pressure, that prevented the return of the condensate to the boilers. It was found that the few degrees reduction in the temperature of steam between 2 lbs. gage and 2 in. of vacuum was enough to cause all the thermostatic traps on the return ends of the coils to open and thus balance the pressure between steam and return mains. This left no unbalanced pressure to lift the condensate from the return main to the vacuum pump receiver and therefore allowed the condensate to settle into the low parts of the return main. There was considerable evaporation of the water in the boilers due to the reduced pressure even with banked fires, and as no condensation was being returned, the water level was soon lowered enough to cause the cracking of the boiler sections.

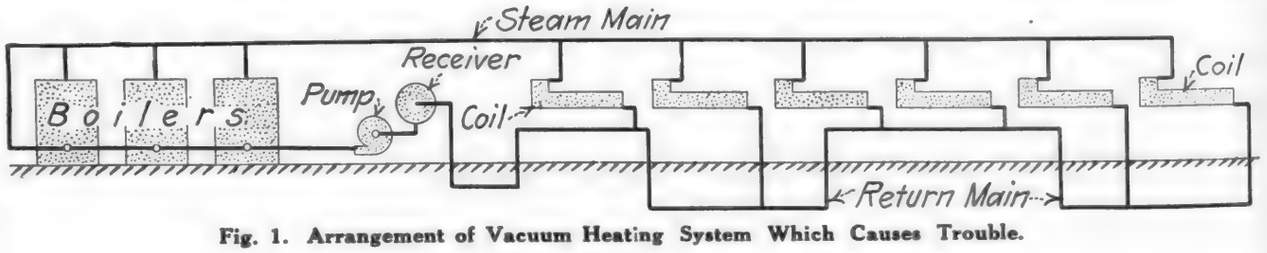


Fig. 1. Arrangement of Vacuum Heating System Which Causes Trouble.

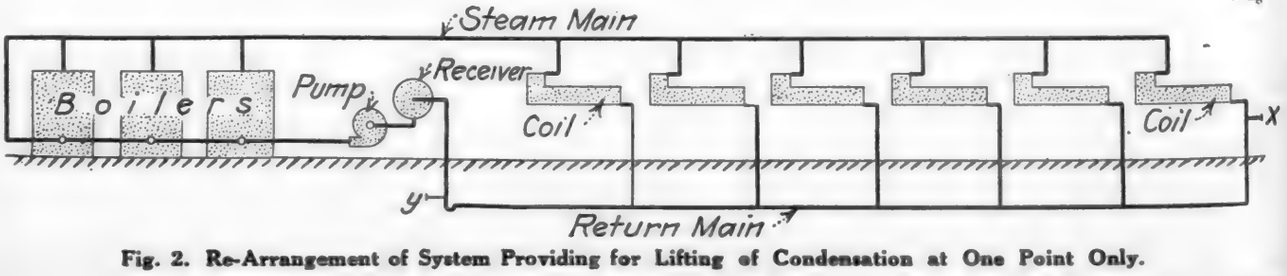


Fig. 2. Re-Arrangement of System Providing for Lifting of Condensation at One Point Only.

HOW THE TROUBLE WAS REMEDIED

Having located the cause of the trouble the next step was to find a way to overcome the danger to the boilers. It was immediately apparent that no great changes could be made in the return piping because of the great expense involved, so some other method had to be found. A careful study of all the conditions indicated that an automatic boiler feeder of the duplex type could be installed, arranged to feed city water to the boilers when the condensate was not returned fast enough to maintain the proper water level in the boilers. The excess was wasted to the sewer when the water level became too high. Of course this feeder wastes some hot water but this is much less expensive than the attendance necessary to hold the pressure in the boilers above atmospheric pressure at all times.

In laying out a vacuum heating system to be operated from low-pressure boilers it should, if possible, be arranged so the condensate will flow to the vacuum pump by gravity. Where this cannot be done the system should be arranged as shown in Fig. 2 so that the lifting of the condensate occurs at one point only, and that as near the vacuum pump as convenient. This lift should be made in two or more steps if the vertical distance is over 4 ft. Good lift fittings should be used in preference to home-made fittings and the vertical pipe should be at least one size smaller than the horizontal runs.

A graduated air leak at point X would insure more positive action of the vacuum pump in returning the condensation, but the pump should be made of larger capacity to handle the extra amount of air.

A second small graduated air leak at Y might be useful to reduce the vacuum necessary to lift the condensation if the lift is too high. Where the condensate cannot be returned to the boilers by gravity, duplicate vacuum pumps connected to the same receiver should always be installed, keeping one as a spare as a safety measure.

It is also good insurance to put in, and keep in good operating condition, an automatic duplex boiler feeder to maintain a proper water level in case the vacuum pump should stop, due to failure of the electric power or any other cause.

Correspondence

Determining the Air Capacities of Vacuum Pumps

EDITOR HEATING AND VENTILATING MAGAZINE:

Can you advise us the state of current standards in determining the size of air pump for a heating system? In other words, what capacity should a vacuum pump have in cubic feet of air per minute for various installations of say 1,000, 2,000, 5,000, 10,000, 15,000 and 25,000 sq. ft.?

We trust you may enable us to proceed upon standards recognized by the heating industry.

H. D. YODER,
Engineer Injector Division,
Penberthy Injector Company.
Detroit, Mich.

Quite often good judgment based on a wide experience, plus a knowledge of the heating installation, is necessary, in addition to knowing the amount in square feet of equivalent radiation, in order to estimate the probable volumes of both water and elastic fluids of condensation, necessary degree of vacuum at the pump and head against which the condensation must be delivered.

Some good information along these lines is contained in "Steam Heating" published by Warren Webster & Company, and the following notes are taken largely therefrom. As stated therein for conditions requiring lift points in the return, or where there is inleakage around inlet valves or elsewhere, or where large volumes of high-temperature returns enter near the pump, or if the run of piping from source of steam supply to farthest radiator is long, or where the radiator traps leak steam, additional factors must be applied to insure the proper size of pump. These factors cannot be summarized since their selection is entirely a matter of judgment and experience with similar conditions.

The volume of condensation varies in different installations fully 40% per square foot of equivalent direct radiation. The volume of air, water, vapor, steam and gases from impurities also varies with the initial and terminal pressures, with the efficiency of the traps, with the amount of inward air leakage, with the probable cooling effect in the return, and with the character of the impurities in the boiler feed.

Lifts in the return require a greater terminal vacuum with consequent greater expansion in volume of the elastic fluids, thus requiring greater pump displacement, and for this reason should be avoided, where possible.

Discharge head on reciprocating vacuum pumps increases clearance and slip and thereby decreases the effective displacement. A discharge head of more than one additional atmosphere on reciprocating pumps is best handled by separating the water and gases and removing them independently through two separate pumps.

For slip in reciprocating wet-vacuum pumps it is seldom safe to allow less than one-sixth of the displacement, although a newly-packed pump may show much less.

Systems in which the pressure throughout the supply lines and radiation as well as in the returns, is normally less than that of the atmosphere are subject to invisible inleakage of air around the valves and fittings. Such systems require increased displacement also because of the greater volume of elastic fluids, due to low terminal pressure necessary for circulation.

Cooling and consequent reduction in volume of the elastic fluids in the return present an element of considerable magnitude and uncertainty.

Well-insulated return pipes, also large volumes of condensation entering the main return close to the vacuum pump, require greater displacement than would the same radiation with returns in which a considerable portion of the vapors could condense between the radiation and the pump.

Clearance reduces effective displacement in all pumps. The clearance for a given cylinder diameter in reciprocating pumps of some makes is approximately the same in short-stroke as in long-stroke pumps. Commercial sizes of reciprocating vacuum pumps vary in ratio of bore to stroke between 1 to ¾ and 1 to 2; it follows that a pump of the latter proportion has greater efficiency per displacement than the short-stroke pump, because of smaller percentage of clearance.

Experience with reciprocating steam-driven vacuum pumps indicates that for most favorable conditions the use of water cylinders of less displacement than eight times the normal volume of water of condensation is seldom safe. With radiation divided into small units, a ratio of at least 10 to 1 will be required.

Ratings for the rotating combination units should be based substantially on a 10 to 1 ratio of the combined displacement of water and air cylinders, the ratio of these cylinders to each other being about 2 of water displacement to 3 of air. In these pumps the displacement of water must be high on account of the constant speed, while a lower proportion of air displacement may be taken because of the high efficiency of the air chamber, as compared with reciprocating pump cylinders which have greater clearance.

The speed and displacement in rotating pumps are normally constant, unless expensive variable speed motors are used, whereas in reciprocating steam-driven pumps piston speed may be varied through a wide range. The temptation to gain displacement by ex-

cessive piston speed without regard to the consequent racking of the pump because of too frequent starting and stopping of pistons and valves, should be avoided by adhering to a definite relation between piston speed and length of stroke.

The following example will fully explain the method of calculations for sizing vacuum pumps. Assume a pump having a 4-in. stroke and 4-in. bore, the area of its cylinder is 4x4x0.7854= 12,568 sq. in. or 0.0873 sq. ft.

The piston speed is $20x\sqrt{4}$=40 ft. per minute, or 2400 ft. per hour.

The gross displacement is therefore 0.0873x2400=209.52 cu. ft per hour, of which the gross water displacement is one-tenth, or 20.95 cu. ft. per hour.

Since the condensation will weigh 60 lbs. per cubic feet at about 200°F. the gross water displacement may be expressed as 20.95x60=1257 lbs. per hour. This must be reduced one-sixth because of slip, or to 1047 lbs. of condensation per hour, as a basic rating for this pump.

Taking the average B. T. U. per pound of condensation as 970, the basic rating for the same pump may also be expressed as 1,015,600 B. T. U. per hour.

Ratings for vacuum pumps are properly expressed only in terms of pounds of water condensed by the heating system in a given period of time, or the equivalent latent heat in B. T. U. given up by the steam while condensing. Ratings in terms of "square feet of direct radiation" are not strictly correct and may be misleading since there is no recognition of steam pressures, temperature difference, and other factors entering the problem.

In proportioning the steam cylinder, the following is a safe rule to use. The area of the steam cylinder in square inches times one-third the boiler pressure should equal the water piston area in square inches, multiplied by the combined pressure on the water end (vacuum plus discharge pressure) expressed in pounds per square inch. This is given by the following equation.

$$A_s \times \frac{P_b}{3} = A_w \times \left(\frac{V}{2} + P_d\right)$$

From which we have

$$A_s = \frac{A_w \times \left(\frac{V}{2} + P_d\right) \times 3}{P_b}$$

in which

A_s=area of steam piston in square inches.

A_w=area of water piston in square inches.

P_b=boiler pressure in pounds per square inch.

P_d=discharge pressure in pounds per square inch.

V=vacuum at pump expressed in inches of mercury.

$\frac{V}{2}$=approximate vacuum in pounds per square inch (2 in. mercury=approximately 1 lb. per square inch)

Note: All pressures are by gauge.

In the above formula, the working pressure is taken as one-third of the boiler pressure in order to allow for the low mechanical efficiency of the pump, as well as for the inevitable drop in steam pressure between the boiler and the inlet of the pump. Carelessness in setting up the packing in the water-and-air piston is prevalent and to be expected. It is also necessary for the pump to keep going even when the boiler pressure may be considerably lower than the normal working pressure.

While in some cases this formula may give dimensions which appear to be larger than necessary, it is seldom safe to make the area of the steam cylinder less than twice the area of the water-and-air cylinder.

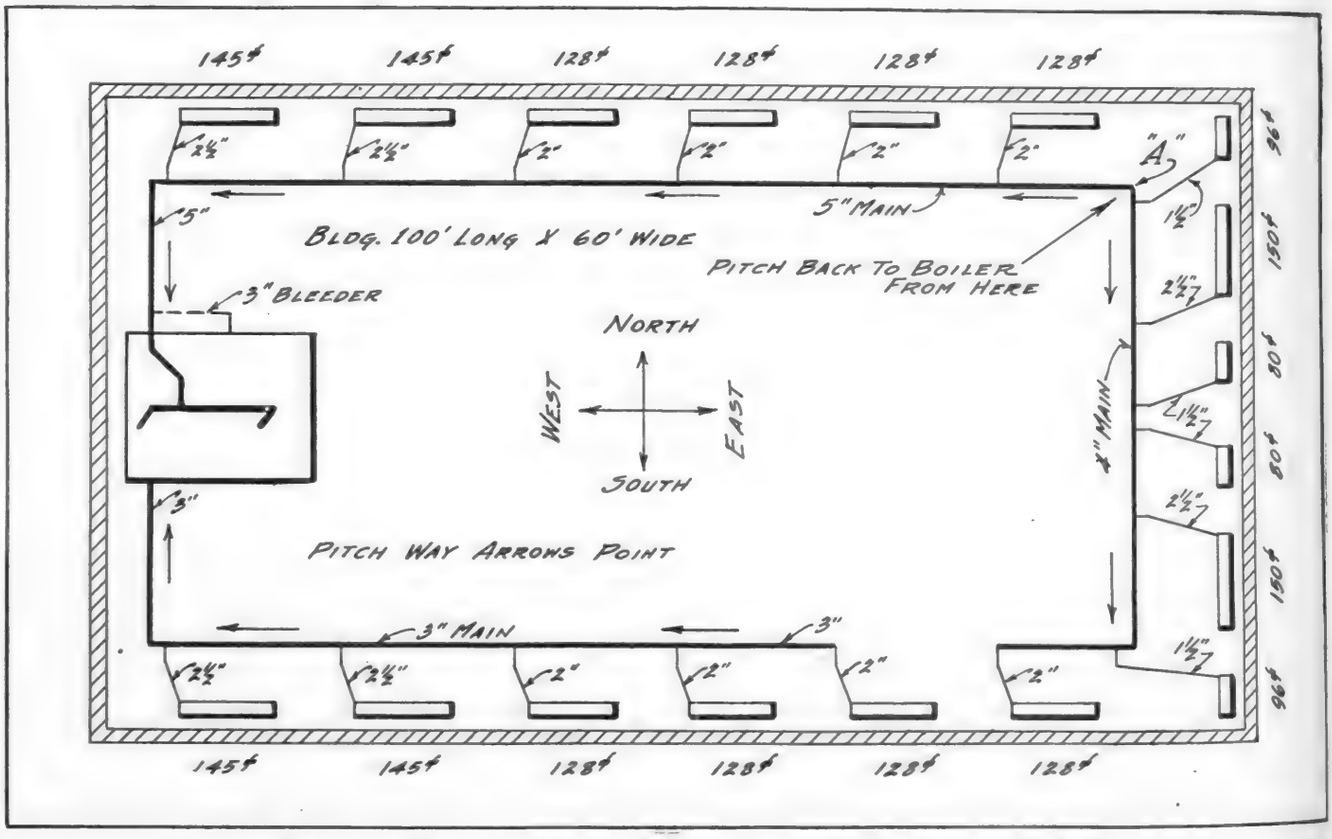
Why Water Leaves Boiler in One-Pipe Heating System

EDITOR HEATING AND VENTILATING MAGAZINE:

I enclose sketch of steam job that is giving trouble. When we fire the boiler in cold weather, the water leaves the boiler. I am wondering if the trouble is in the piping. The 5-in. main, which is about 120 ft. long, pitches back to the boiler. In mild weather this does not cause so much trouble.

Could the 3-in. bleeder be the cause of water leaving the boiler?

New Hampton, Ia. H. J. F.



One-Pipe Heating System Which Gave Trouble Due to Water Leaving Boiler.

It requires good judgment and a wide experience to design a successful strictly one-pipe steam heating system. Even where the runouts to radiators are two-pipe, the operation of the system is not always as desired, unless the piping has been arranged with increased sizes of pipes and ample pitch.

In looking over the sketch submitted it will be apparent that the trouble lies in the design. It is unusual to lay out such a system with the condensation flowing counter to the passage of steam. Furthermore, the trouble is increased due to the high point of the main at "A" where the main changes in size and condensation drains in different directions, the steam continuing on in the same direction as before. If the main had been very short and arranged with a decided pitch and connected to radiators of smaller size, it might have been possible to drain the main back to the boiler, though this is not advisable in any case.

It has long been customary to design one-pipe systems with the steam main rising close to the ceiling at the boiler and then pitched down uniformly from this point with a grade of 1 in. to 10 ft. and with the full size of the main continued to its end. The end of the main should be dropped and preferably run back to the boiler as a wet return with an automatic air valve installed at the point where the main drops wet.

The end of the main should also be kept at least 12 in. to 18 in. above the normal boiler water-line. Quite often much more than this is required depending upon the drop in pressure for which the system was designed. As the pressure of the steam in the boiler acts downward upon the water it forces the water out of the boiler into the return and up into the steam main, because the steam pressure in the boiler is greater than that at the end of the steam main. Friction to the passage of steam, as well as condensation of the steam, causes this drop in pressure. The steam as it condenses leaves a partial vacuum or place of lower pressure. Obviously, the drop in pressure would be greatest when the steam flow is greatest which would be in cold weather, or when starting up with a cold system. In the case in mind, the steam flowing counter to the condensation is retarded in its flow, causing the greatest drop in pressure at the high point "A", and as a consequence of this restricted flow of condensation and pressure drop, the condensation will tend to be forced backwards or piled up at the high point.

Assume, for the sake of illustration, that the boiler is being operated at 5 lbs. steam pressure which is reduced to 4 lbs. by the time it reaches the high point, or for that matter, even beyond this point, say, up to the last radiator connection. Then the steam within the boiler forces the water downward and up into the steam main, approximately 29 in. for each pound difference in pressure, this distance being the height of water column required to offset, due to its weight, the difference in steam pressure. If a check valve were placed in the return the water would not back up, but the check would remain closed until the above height of water column were reached.

Of course, water leaving the boiler can be and often is caused by many other factors. For example, priming and foaming from dirty water, or a high velocity of steam, carrying water over from the boiler, as would come about from insufficient number and size of steam outlets, particularly in cold weather or when starting up, at which times the steam demand is greatest. The steam header should be well up above the boiler with the branches taken from the top of the header and the bleeder then taken from one end of the header, instead of from the main as shown. This prevents the water from entering the mains. Also as previously explained, the pressure in the main is not the same as in the boiler, but, instead, is constantly decreasing as it flows away from the boiler.

T. W. R.

Chicago Adopts Certified Heating

Word has been received from the Chicago Master Steam Fitters' Association of the adoption by the association of the plan of certified heating for bungalows, residences and apartment

"Certified Heating" Plate Used by Chicago Heating Contractors.

building under four stories. As is well known, this plan embodies a guarantee on the part of the association of the work of its members. According to the terms of the guarantee the association will adjust without charge any complaint regarding defective workmanship or materials or overcharges.

In the case of the Chicago association's guarantee, "Certified Heating" will mean that the heating equipment installed is in accordance with the published standards of the Chicago Master Steam Fitters' Association. When certified heating is installed, the certificate is issued to the architect and a plate bearing the certificate's number and contractor's name is affixed to the boiler.

More than 50,000 bungalows, residences and three-story apartment buildings in Chicago, states the association, are successfully heated because the installations are in accordance with the association's standards. Only members of the association can supply certified heating, but membership is open to every heating contractor of good reputation who will pledge himself to conform to the association's standards of engineering and workmanship.

Sanitary Equipment Scholarships Established at Carnegie Institute of Technology

In accordance with a movement initiated by the National Association of Plumbers at its meeting in Atlantic City two years ago, the association has just established a scholarship fund of $1,000 to be awarded in the form of two scholarships of $500 each in sanitary equipment at the Carnegie Institute of Technology. The courses are intended to apply particularly to plumbing. The scholarship fund becomes effective for the college year of 1925-1926 and it is expected that the first appointments will be made during the coming summer. The scholarships will be awarded to sons of master plumbers under the direction of the association's Scholarship Committee, composed of Frank J. Fee, chairman, who has long sponsored the idea: John J. Vogelphol, Samuel F. Wilson, Alfred C. Eynon and James S. Cassedy.

The course in sanitary equipment at Carnegie Institute of Technology is a four-year course leading to a degree of bachelor of science and is given in the Department of Heating, Ventilating and Sanitation, of which Professor S. E. Dibble, president of the American Society of Heating and Ventilating Engineers, is the head.

Drying Drowned Motors

High water in the Lackawanna Valley has played havoc with the equipment of the mining companies in that district. One of them was particularly unfortunate, when the river broke through into one of its mines unexpect-

Underground Pump Room in Which the Submerged Motors Were Located.

edly and thousands of tons of water rushed into the workings. The underground pumping stations were, of course, flooded. In one of these were five 1000 H.P. motors, each driving a 5,000-gal. pump at 550 ft. head. These motors were completely submerged for five days before the water had receded sufficiently for men to get into the pump room. They found that the motors were covered with heavy slime and full of grit and dirt.

The first thing that was done was to turn the hose on the motors and thoroughly wash them off with clean water. The bearings were cleaned out and the dirt removed from the windings. Each motor was then surrounded with Westinghouse electric space heaters and the temperature gradually raised to the maximum practical temperature. This heat was continued for approximately twenty-five days, at the end of which time the motors were placed back in service and have been operating successfully ever since without any other drying-out method than the one described.

Had it not been for the electric heaters, it would have been necessary to remove the motors from their foundations, take them up through the shaft to the surface of the ground where they could be dried out by some other means. Electric heat did the job without this trouble.

Novelty Boilers Rated on a New Basis

In a notable publication (Handbook and Catalog No. 78) just issued by the Abram Cox Stove Co., Philadelphia, Pa., the trade is informed of the company's reasons for abandoning general boiler ratings and is furnished with the data upon which the company recommends the selection of boilers for any job.

The information given in the handbook is based upon the following: (1) that the boiler is working under given conditions as to chimney size and height with the resulting available draft, (2) that this available draft determines the rate of combustion, (3) that this rate of combustion determines the rate of evaporation, (4) that the burning of coal at this rate of combustion multiplied by the square feet of grate surface determines the total amount of coal to be burned per hour, (5) that this total amount of coal burned per hour multiplied by the rate of evaporation per hour, determines the total number of pounds of steam available per hour at the outlets. (Line 4 in accompanying table).

Having given the amount of steam available at the outlets, the engineer, it is pointed out, then can readily determine how this amount is to be distributed. In expressing the pounds of steam per hour as the total condensing load in terms of standard column direct steam radiation (line 5), the factor has been used of 1 sq. ft. of standard column direct steam radiation transmitting 240 B.T.U. per hour, so 4 sq. ft. condenses 1 lb. of steam per hour.

Having given the total condensing load (line 5) the net equivalent standard column direct-steam radiation (line 6) is obtained by subtracting from the total condensing load, the accepted average of 20% of that load to allow for the amount of heat lost through mains and risers. Or to work from line 6 to line 5, as is frequently done, add 25% to the net equivalent standard column direct steam radiation to obtain the total condensing load. If in any actual installations these proportions vary, the heating engineer can make the necessary allowances, inasmuch as the total steam available at the outline is known.

In arriving at the net capacity of a boiler in terms of standard column direct water radiation (line 7) the unit used is 150 B.T.U. transmission per square foot of standard column direct water radiation per hour against 240 B.T.U. transmission per square foot of standard column direct steam radiation per hour in establishing the factor 1.6, that is, the amount of the net equivalent standard column direct steam radiation is multiplied by 1.6 to calculate the net equivalent standard column direct water radiation.

Included in the handbook are notes on chimney flues with available draft tables, data and tables for determining the total condensing load in terms of square feet of standard direct column cast iron radiation, net steam and water radiation tables at varying rates of combustion, and tables giving total steam pounds per hour available at the outlets on Novelty steam boilers at varying rates of combustion.

An interesting comparison is made in the handbook of so-called commercial ratings and those now offered by the company based on actual amount of net equivalent column radiation which Novelty boilers will carry under specific conditions. These comparative ratings are arrived at by taking the net equivalent column radiation which each boiler will carry under a specified average condition and adding 100% to that amount.

TYPICAL TABLE FOR RATING NOVELTY BOILERS

	Novelty Boiler—No. 25-8 Grate area 11.13 sq. ft.							Novelty Boiler—No. 25-9 Grate area 12.71 sq. ft.						
1—Rate of combustion in lbs. of coal per sq. ft. grate per hr.	5.0	5.5	6.0	6.5	7.0	7.5	8.0	5.0	5.5	6.0	6.5	7.0	7.5	8.0
2—Evaporation lbs. of water per lb. of HARD coal	8.3	8.5	8.7	8.9	8.9	8.9	8.7	8.3	8.5	8.7	8.9	8.9	8.9	8.7
3—Coal lbs. per hour	55.7	61.2	66.6	72.3	77.9	83.5	89.0	63.6	69.9	76.3	82.6	89.0	95.3	101.7
4—Steam lbs. per hour	462	526	581	645	693	743	774	528	594	663	735	792	848	885
5—Total condensing load in terms of direct column radiation sq. ft.	1848	2080	2324	2572	2772	2972	3096	2112	2376	2652	2940	3168	3392	3540
6—Net direct steam radiation or equivalent sq. ft.	1478	1664	1859	2058	2218	2378	2477	1689	1900	2121	2352	2534	2713	2832
7—Net direct water radiation or equivalent sq. ft	2365	2662	2974	3293	3549	3805	3963	2702	3040	3394	3763	4054	4341	4531
8—Required draft in inches of water*	.11	.135	.16	.19	.22	.25	.285	.11	.135	.16	.19	.22	.25	.285
9—Chimney { Size inches	12 x 16	12 x 16	12 x 16	16 x 16	16 x 16	16 x 16	16 x 16	12 x 16	12 x 16	16 x 16	16 x 16	16 x 16	16 x 16	16 x 16
Height ft.	25	30	35	35	40	45	55	25	30	35	35	40	45	55

See notes on chimney sizes, pages 38 to 44.
For soft coal take 75% of items 2-4-5-6-7.
Chimney size and height (item 9) applies to tight, straight, individual flues lined or unlined and not influenced by surrounding objects.
*Item 8 indicates measurement with draft gauge in smoke-hood of boiler on boiler side of damper.

What a Sanitarian Thinks of the Ohio Ventilation Law

Views typical of those felt by many sanitariums on the subject of our State ventilation laws are expressed by C. E. A. Winslow, professor of public health in the School of Medicine, Yale University, in a letter to Mr. Herbert B. Briggs, of the Ohio State Department of Highways and Public Works. The letter was written in connection with the recent attempt to repeal the Ohio law requiring the change of the air in school rooms six times per hour.

"Laws of this type," declares Professor Winslow, "are a relic of outworn and exploded theories of ventilation and should be eliminated as rapidly as possible. The standard which calls for the change of school room air six times an hour (or the supply of 30 cu. ft. of fresh air per minute per pupil is based on work carried out between 1860 and 1870 by the German hygienist, Pettenkefer, who thought that there were organic poisons present in the air and estimated that this amount of air was necessary to dilute them.

"The work has been carried on during the past twenty years, particularly that of Hill and Haldane, in England, and of Benedict and the New York State Commission on Ventilation, in this country, have proved beyond any question that there are no such mysterious organic poisons present, and that the harmful effects of bad air are due to overheating.

"Our modern conception of ventilation is therefore the supply of cool (not cold) air to take the place of air warmed by human occupancy.

"With our present understanding of the subject there is not the slightest reason for the installation in schools of mechanical ventilating plants supplying 30 cu. ft. of air per minute or changing the air six times an hour. I estimate that two and one half million dollars are wasted in constructing such

systems in this country every year and the additional cost of operation is even greater. Furthermore, these mechanical ventilating systems in the class room are not only wasteful and extravagant, but positively harmful. A change of air six times an hour produces a draft upon the faces of the pupils which necessitates the overheating of the air to protect against drafts and this overheating is seriously harmful to the health and efficiency of the pupils.

"In the New York State Commission studies we found 18% more absence due to respiratory sickness and 70% more respiratory sickness among pupils in attendance in fan-ventilated rooms, as compared with those ventilated on the rational modern system of window inlets and gravity exhaust ducts with a low flow of cool air.

"If you can secure the repeal of this law you will not only be saving the state hundreds of thousands of dollars but will be doing a real service in protecting the health of its children."

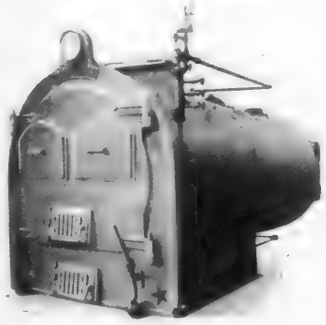
New Apparatus and Appliances

Stanwood Smokeless Boilers

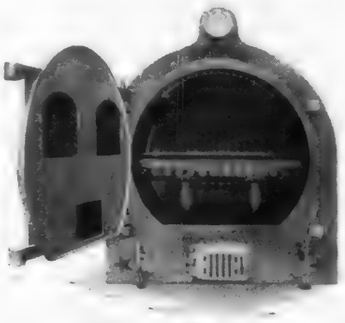
A heating boiler of the down-draft horizontal type, manufactured by Houston, Stanwood & Gamble Co., Cincinnati, O., is an interesting addition to the types on the market. The boiler is a plain shell, with tubes centrally located, and with a single passage for the gases from furnace to smoke-box. The tubes constitute the greater portion of the heating surface. circulation, from the feed pipes into the manifold, and thence through the grate tubes into the boiler near the top.

Mechanically the boiler is well designed and constructed. No rivited seams are exposed to the fire, and, except for the heads there are no flat surfaces to be stayed.

Sizes from 300 to 2,000 sq. ft. of heating surface are standard for pressures of 15 to 125 lbs., and pressures up to 200 lbs. are provided on special order.



Front View.



View of Firebox.

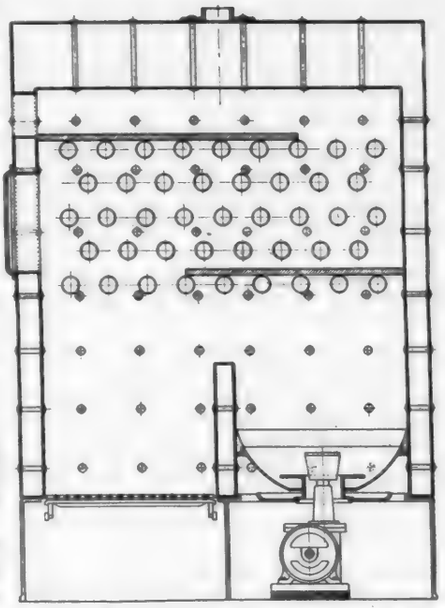
Construction of Stanwood Smokeless Boiler.

The furnace is located at the end of the boiler shell, and is of the conventional type, with primary upper grate of water-tube grate bars, and a secondary shaking grate below. The water-tube grates are taken from a horizontal manifold at the front of the furnace, and lead into the front head of the boiler above the tubes.

This design promotes rapid internal

A Combination Oil and Garbage Burner

A boiler which makes possible the burning of oil, and coal or rubbish, at the same time, has been developed by the Page Water Tube Boiler Co., 815-819 Larabee Street, Chicago, Ill., and is being marketed under the name of the Johanson combustion steel boiler.

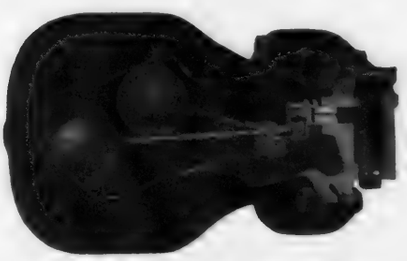


Design of Johanson Combination Oil and Garbage Burner.

The furnace is divided into two units, one for burning oil and the other for burning coal, garbage or rubbish. Either unit, it is stated, can be operated independently of the other or they can be operated together. The boiler is welded and has no rivets. Careful baffling has been arranged to give the maximum of heat transfer before the stack is reached. One of the advantages mentioned for this boiler is that an interruption of the electrical current for igniting the oil will not interfere with the operation of this heater, as coal and wood can be fired on the grate side until the electric current comes on again.

A New Duplex Water Feeder

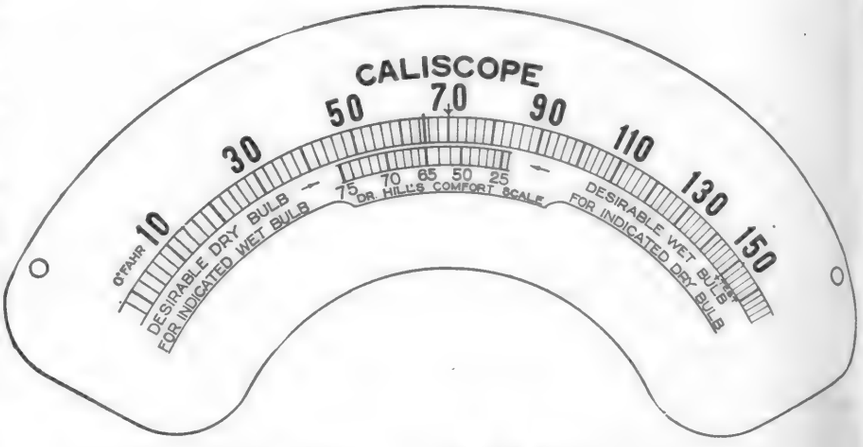
What is described as a new and simple method of controlling the water-line in a low-pressure steam boiler has been developed by McDonnell & Miller, Conway Building, Chicago, and is embodied in a novel type of duplex water feeder. The water feeder is designed automatically to supply make-up water from the city main to compensate for leaks in the system and also to protect the boiler against flooding. It is described as being particularly adapted to gravity systems where the condensation may be held in the circuit by the boiler pressure, returning in large quantities as the pressure drops or suffi-



McDonnell & Miller Duplex Water Feeder.

cient head is created to send condensation back against boiler pressure.

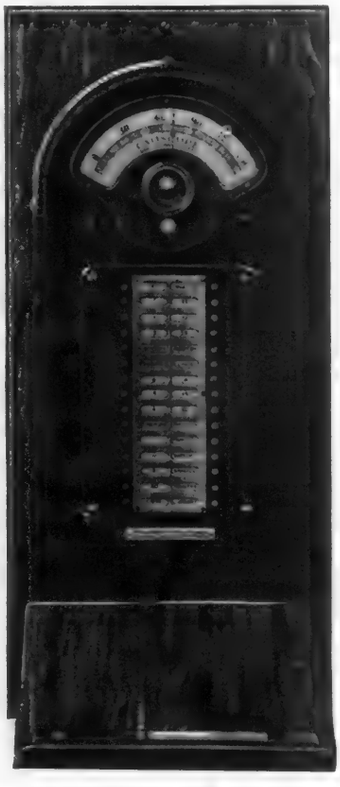
A notable feature of the appliance is its few number of parts. There are two float-operated valves in the head, encased in a receiver. These valves are of bronze. They are vertical and of the self-cleaning type. An integral strainer is also placed in the head, with an extra large strainer basket to avoid frequent cleaning. All pipe connections are unified in the head. By removing the body the working parts are accesible without breaking a single pipe connection.



Dial of Caliscope with Hill Comfort Scale.

A Temperature-Indicating System With New Features

Remote reading of dry-bulb and wet-bulb temperatures from a dial so arranged as to show how far either reading varies or both depart from those desired, are provided for in the latest design of the Caliscope, an electrical temperature-measuring instrument manufactured by the American Temperature Indicating Co., 1017 Summit Street, Toledo, O. In addition to the use of dry and wet-bulb thermometers the dial includes the Hill comfort scale for ascertaining the correct temperatures required. The Caliscope, it is pointed out, is not an automatic device to regulate temperatures, and in itself has no control over the heating apparatus. In a school building it is intended to be placed in the janitor's or custodian's office. It is connected by means of wires to electric thermoscopes located in the schoolrooms. To ascertain the dry and wet-bulb temperatures in the rooms, the custodian pushes the buttons which are numbered the same as the rooms. As the buttons are pushed the Caliscope indicates the temperatures on the dial.



Caliscope for Remote Readings of Dry Bulb and Wet Bulb Temperatures.

In addition to its use for general work the instrument is described as especially practicable for inaccessible places and in manufacturing processes, such as cold storage plants, drain storage bins, mines and refrigeration.

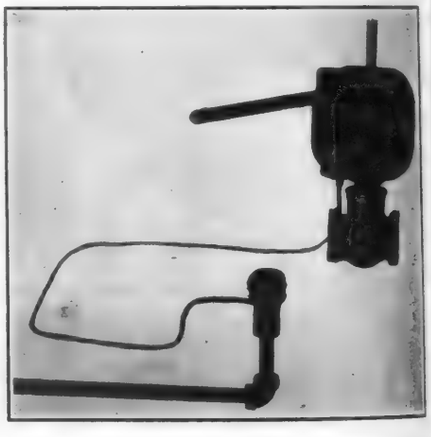
New Master Control for Gas Fired Boilers

In a new three-control type of control, developed for gas-fired boilers by the A. H. Wolff Gas Radiator Company, New York, safety is automatically provided for in case the pilot is extinguished through the use of an interlocking master control.

The main gas control is under the control of the house thermostat, which operates in only two positions, "on" and "off." With the pilot out, even if the house control calls for gas, the main valve remains in an "off" position, but after the lighting of the pilot, the main gas valve is rendered operative by the house thermostat. This is accomplished through the functioning of a closed tube, one end of which is coiled around the pilot tube. The other end terminates in a metal bellows in the control casing, where, through a link motion, it either permits the snap-acting gas valve to operate, or locks it shut. Thus the accidental extinguishing of the pilot makes it impossible to turn on the gas again before it has been re-lighted. If any part of the safety pilot mechanism should get out of order, or the connecting tube break, the gas is automatically turned off.

The normal functioning of a gas-fired boiler is so regular that the owner often neglects the installation even to the extent of maintaining proper water level, so it has become necessary, on account of human frailties, to add another thermostatic control, a low water-line cut-off, which, as its name implies, prevents the main snap valve from acting should the water in the boiler drop below a predetermined level. It then becomes impossible to turn on the gas, even with the pilot lighted, until the water level has been raised to a safe point.

The snap-acting gas valve is connected by a rod to the steam regulator on steam boilers and to the water temperature regulator on water boilers, which, in turn, are connected with the room thermostat. None of the functions of any one of the devices interferes with the functions of the others, except when necessary from a safety standpoint, such as the blowing out of the pilot, or lowering of the water-line to an unsafe level.

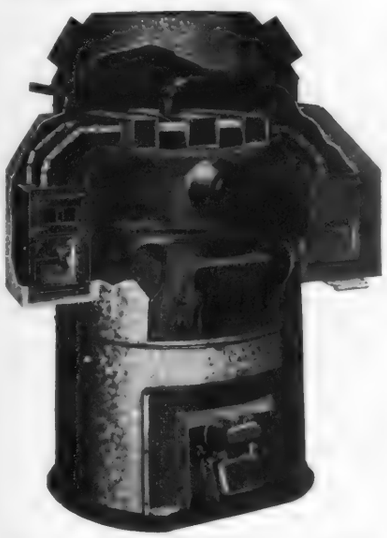


New Three-Control Safety Device for Gas-Fired Boilers.

Gas-Heating Attachment for Warm-Air Furnace

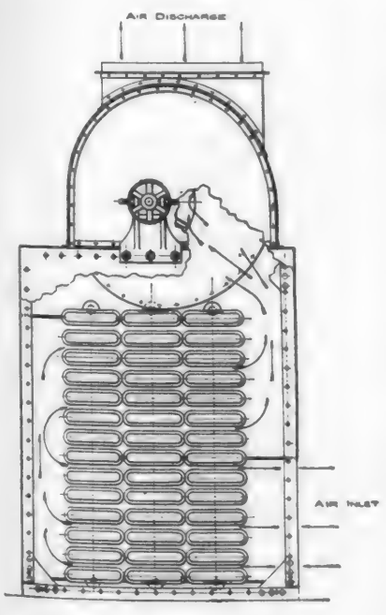
To meet a demand for a method of burning gas economically in a combination warm-air furnace, an appliance has been designed by the American Furnace Co., Cleveland, O., which is being marketed under the name of the Little Ben heater. It is designed for use especially in the Moncrief or similar type of warm-air furnace.

This device, it is pointed out, is built into and not attached to the coal furnace. Its heating drums are located in the top of the coal furnace near the warm-air outlet and in the direct passage of cold air circulation. The heater is made of heavy ingot iron to withstand moisture and heat and at the same time to give free radiation.



Warm-Air Furnace Equipped With Gas-Heating Attachment.

When the Little Ben heater is not in use, it is so placed that there is no interference with the operation of the main furnace burning coal; in fact, more radiating surface is provided. When desired, both furnaces can be used at the same time. No change of cold-air supply dampers or warm-air dampers is necessary when operating the auxiliary heater. A high degree of efficiency, it is stated, is secured through the construction of the main furnace of cast-iron, and of the gas furnace, of sheet-iron.



Design of Stickle Blast Coil Heaters.

Stickle Blast Coil Heater

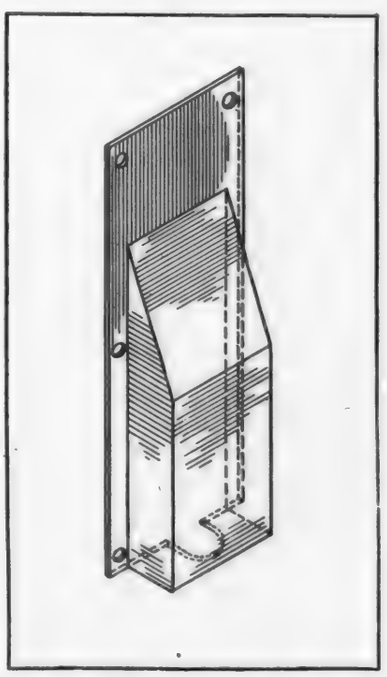
Novel features of design are embodied in the new S. S. S. unit heater which has been placed on the market by the Stickle Steam Specialties Co., Indianapolis, Ind. These units are equipped with the Stickle vapor-vacuum type of heating coil for blast coil service which have been found particularly applicable to this class of work in maintaining a positive circulation through every section of the unit. Each section is described as a continuous return coil being designed to permit a continuous reevaporation of the condensation. The condensation flows in a thin film over the bottom of the coil leaving a steam-liberating space above the water. This brings the steam into direct contact with the condensation the full length of the coil. This blast coil is described as the only blast coil made in which high pressure condensaton is discharged into a vacuum and converted into steam and made available for supplying heated air in blast coil service.

New Trade Publications

Modern Heating and Ventilating, devoted to the B. & B. line of heating specialties and ventilating equipment manufactured by the Bishop & Babcock Co., Cleveland, O., and its subsidiaries, the Massachusetts Blower Company and the Thermograde Valve Company, is the title of the second edition of the Bishop & Babcock Company's latest catalog. Details and other data regarding each product are arranged in convenient form for quick reference and there is also a full index. One of the most interesting new products described in the catalog is the B. & B. allmetal dual thermostat for application in buildings where control of individual rooms or sections is desirable. It is manufactured in positive, intermediate and compound types and is used in connection with the B. & B. Multiflex all-metal pneumatic valves and other specialties. Other data incorporated in the new edition refer to Massachusetts propeller fans, Type J, and Massachusetts automatic shutters. Size 4 x 7-in. Pp. 292.

The Ideal Fitter, 21st edition, has been issued by the American Radiator Company, New York, and embraces a number of new features which add to its usefulness. Different-colored pages, for instance, are devoted to the boiler, radiator, specialty and engineering data sections, respectively, while each section is completely indexed. Many of the illustrations appear in color adding much to the attractiveness of the manual. The Ideal Fitter, which has long occupied an important place in heating literature, will be found even more valuable in its present form. Size 4 x 7 in. Pp. 341.

CHAMBERLIN METAL WEATHER STRIP details are the subject of a well-compiled series of data sheets issued by the Chamberlin Metal Weather Strip Co., Detroit, Mich., and covering all of the applications of metal weather stripping furnished by the company, including those for double-hung windows, casement windows, hollow metal windows, austral windows, transom windows, doors and door bottoms. Remarkably well-drawn window details accompany the description of each application. There is also a general and descriptive specification given for each type of weather strip, supplemented by detailed drawings of the strip in question, tabular data for zinc and bronze construction, and notes on the construction of the stripping itself. While the sheets are prepared especially for architects they will be found of almost equal value to heating engineers and others interested in tight building construction. In an effort to reduce elsewhere in-leakage the company has perfected a pulley guard to stop the leakage through the pulley holes. Size 8¼ x 11¾ in. Pp. 48.

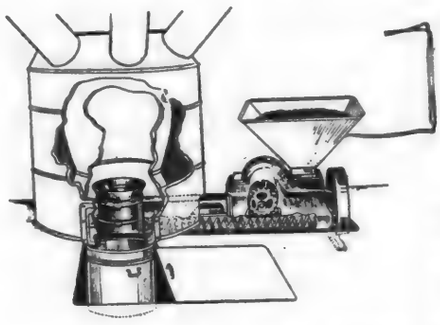


Design of Pulley Guard to Stop Air Leakage Through Window Pulley Holes.

HOW TO OPERATE YOUR HEATING PLANT WITH LESS COAL is the title of a manual by L. R. Taylor, issued by the International Heater Co., Utica, N. Y., and containing some sound advice on the operation of warm-air, water and steam heaters, using either hard or soft

coal. Other recent publications of the company include catalogs on the International Economy line of round, sectional and smokeless boilers. In each case revised ratings are given for the types shown.

ELECTRIC COAL BURNER designed to burn low-grade coal in any type of heating furnace has been brought out by the Electric Coal Burner Co., 110 North Desplaines Street, Chicago, Ill. It is



Electric Coal Burner for Burning Low Grades of Coal.

operated by an electric motor controlled entirely by a thermostat placed at a desirable point in the building. The cost of electric current, it is stated, required by the appliance is about $1.00 per month. The electric coal burner is made in various sizes ranging in capacity from 400 sq. ft. to 16,000 sq. ft. of steam radiation.

MASON REGULATORS are presented in a new catalog (No. 62) published by the Mason Regulator Company, Dorchester Centre, Boston, Mass. A number of new pressure regulators are featured in the catalog and particular attention is called by the manufacturer to the various styles of lever and outside-spring operated regulators covering practically every requirement. The company has further developed a new line of small regulators for air and water which are shown in the catalog, as well as details of its hydraulic regulator which is designed for particularly sensitive and accurate control. The Mason line of balanced valves, it is stated, has been further extended and now covers, in addition to its well-known extra heavy styles, a complete line for pressures up to 125 lbs. Tables are included showing the capacity of reducing valves under varying pressure conditions. They form a valuable adjunct to the catalog.

Design of Boynton-Perco Boiler

In the description of the new Boynton-Perco boiler published in THE HEATING AND VENTILATING MAGAZINE for March, the statement was made that this is the new trade name for another type of boiler as re-designed by Charles B. Boynton. We are informed that the Perco Heater Corporation of Newark, N. J., manufacturer of the Boynton-Perco boiler has no connection with the manufacturer of any other type of boiler, directly or indirectly.

We are also informed that the construction of the Boynton-Perco boiler in no way employs or utilizes any of the devices that are employed in any other type of boiler on the market.

We regret causing any such misconception and, in justice to Mr. Boynton, gladly make this correction.

Organization of Vapor Engineering Company

Announcement is made of the organization of the Vapor Engineering Company to manufacture and distribute a new line of specialties for vapor heating under the name of Veco. Charles E. Scott, former vice-president of the Vapor Heating Company, and for 18 years manager of that company's New York office, is at the head of the new organization in New York, maintaining offices at 489 Fifth Avenue.

Charles E. Scott

Mr. Scott is known as a pioneer in the vapor heating field, having been one of the first to introduce vapor heating in the metropolitan district. It is largely due to the success of his efforts that vapor heating is so favorably regarded today.

During his long connection with the industry he has built up an enviable reputation for a high quality of installation and service as well as for business integrity which will stand him a good stead in his new field of activity.

Deaths

E. W. Newman, manager of Kieley & Mueller, Inc., manufacturers of steam, water and air specialties, New York, who has been associated with the company for the past ten years, died recently.

Edward H. Raymond, vice-president in charge of sales, and a member of the board of directors of Crane Company, Chicago, died aboard a train, on his way to New Orleans. He had been connected actively with the Crane organization for the past 35 years, joining the company as a traveling salesman in 1890. Five years thereafter he became manager of the city sales department in Chicago. A few years later he was made assistant to the manager of branch houses and, on July 1, 1904, became manager of the company's Baltimore branch. On January 25, 1909, he was transferred to the managership of the Philadelphia branch and also had general supervision of the branches in Baltimore and Washington. In 1912 he moved to Chicago to take up the work of assistant secretary of the company and was made a member of the board of directors. Two years later he was elected secretary. On January 20, 1919, he became vice-president in charge of sales.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE published monthly at New York, N. Y., for April 1, 1925.

State of New York, County of New York, ss:

Before me, a notary public in and for the State aforesaid, personally appeared Arthur S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of said publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, Arthur S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor, None.

Business Manager, Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Arthur S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more or total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than of a bonafide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

ARTHUR S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 16th day of April, 1925.

A. L. SCANTLEBURY.

Notary Public, Kings Co., No. 800.

Certificate filed in New York County, Clerk's No. 717.

New York County Register's No. 7596.

(My term expires March 30th, 1927.)

RADIATION COMPUTING—THE REYNOLDS TABLES
Comparative Costs and Heat Emission for 32-in. Radiators
Steam Temp. 215° F. Room Temp. 70° F.

No. 13-YY

No. of Sections	Length	1 Col.						2 Col.						3 Col.						Length	4 Col.					2 Col. Hospital				
		Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam	R.C. Water	Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam	R.C. Water	Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam	R.C. Water		Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam or Water	Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam or Water
1	2.5	952	2.5	3.94	381	.71	.73	1237	3.33	5.18	371	.70	.71	1665	4.5	6.89	370	.67	.69	3	2166	6.5	8.96	334	.77	1391	3.93	5.76	417	.68
2	5.0	1589	5.0	6.57	318	.85	.87	2121	6.67	8.78	318	.81	.83	2835	9.0	10.90	293	.85	.87	6	3513	13.0	14.53	270	.95	2219	6.67	9.18	333	.85
3	7.5	2217	7.5	9.17	296	.91	.94	2903	10.00	12.01	290	.89	.91	3605	13.5	14.92	267	.93	.96	9	4859	19.5	20.10	249	1.03	3051	10.00	12.62	305	92
4	10.0	2845	10.0	11.77	285	.94	.97	3675	13.33	15.20	276	.94	.96	4674	18.0	19.34	260	.95	.99	12	6205	26.0	25.67	239	1.07	3878	13.33	16.06	291	.97
5	12.5	3471	12.5	14.36	278	.97	1.00	4452	16.67	18.42	267	.97	.99	5544	22.5	22.94	246	1.01	1.04	15	7550	32.5	31.24	232	1.10	4710	16.67	19.49	283	1.00
6	15.0	4098	15.0	16.95	273	.98	1.01	5220	20.00	21.60	261	.99	1.01	6512	27.0	26.96	241	1.03	1.06	18	8896	38.0	36.81	228	1.12	5538	20.00	22.91	277	1.02
7	17.5	4725	17.5	19.55	270	.99	1.02	5992	23.33	24.79	257	1.01	1.03	7481	31.5	30.95	238	1.06	1.08	21	10262	45.5	42.37	225	1.14	6369	23.33	26.35	273	1.03
8	20.0	5354	20.0	22.15	268	1.00	1.03	6768	26.67	28.00	254	1.02	1.04	8453	36.0	34.97	235	1.06	1.09	24	11588	52.0	47.96	223	1.15	7196	26.67	29.77	270	1.04
9	22.5	5982	22.5	24.75	266	1.01	1.04	7539	30.00	31.19	251	1.03	1.05	9420	40.5	38.97	233	1.08	1.10	27	13034	58.5	53.55	221	1.16	8025	30.00	33.20	268	1.05
10	25.0	6610	25.0	27.35	264	1.02	1.05	8323	33.33	34.44	250	1.03	1.06	10391	45.0	42.99	231	1.07	1.11	30	14281	65.0	59.09	220	1.16	8856	33.33	36.64	266	1.06
11	27.5	7236	27.5	29.94	263	1.03	1.06	9112	36.67	37.70	249	1.04	1.07	11360	49.5	47.00	230	1.08	1.11	33	15627	71.5	64.65	219	1.17	9684	36.67	40.07	264	1.07
12	30.0	7863	30.0	32.53	262	1.02	1.05	9838	40.00	40.91	247	1.04	1.07	12328	54.0	51.01	228	1.09	1.12	36	16973	78.0	70.22	218	1.18	10512	40.00	43.49	263	1.07
13	32.5	8489	32.5	35.13	261	1.03	1.06	10662	43.33	44.11	246	1.05	1.08	13297	58.5	55.01	227	1.09	1.12	39	18320	84.5	75.80	217	1.18	11341	43.33	46.92	262	1.08
14	35.0	9117	35.0	37.72	261	1.03	1.06	11436	46.67	47.31	245	1.05	1.08	14270	63.0	59.04	227	1.09	1.13	42	19665	91.0	81.36	216	1.18	12169	46.67	50.35	261	1.08
15	37.5	9744	37.5	40.31	260	1.03	1.06	12210	50.00	50.52	244	1.06	1.09	15242	67.5	63.06	226	1.10	1.13	45	21011	97.5	86.93	216	1.19	13000	50.00	53.79	260	1.08
16	40.0	10372	40.0	42.91	259	1.03	1.07	12987	53.33	53.73	244	1.06	1.09	16207	72.0	67.05	225	1.10	1.14	48	22357	104.0	92.50	215	1.19	13829	53.33	57.22	259	1.09
17	42.5	10999	42.5	45.51	259	1.04	1.07	13764	56.67	56.95	243	1.06	1.09	17174	76.5	71.06	225	1.10	1.14	51	23702	110.5	98.06	215	1.19	14658	56.67	60.65	259	1.09
18	45.0	11624	45.0	48.09	258	1.04	1.07	14538	60.00	60.15	242	1.06	1.09	18144	81.0	75.07	224	1.11	1.14	54	25049	117.0	103.64	214	1.19	15486	60.00	64.07	258	1.09
19	47.5	12250	47.5	50.68	258	1.04	1.07	15310	63.33	63.34	242	1.07	1.10	19118	85.5	79.10	224	1.11	1.14	57	26395	123.5	109.21	214	1.20	16314	63.33	67.50	258	1.09
20	50.0	12875	50.0	53.27	258	1.04	1.07	16080	66.67	66.53	241	1.07	1.10	20088	90.0	83.11	223	1.11	1.15	60	27742	130.0	114.78	213	1.20	17162	66.67	70.92	257	1.10
		5½" Wide				1.18	1.21	8½" Wide				1.13	1.16	10" Wide				1.09	1.12		11½" Wide				1.12	8½" Wide				1.23

Radiation Computing—32-in. Radiators.

For 32-In. Radiators

RADIATION COMPUTING—THE REYNOLDS TABLES
Comparative Costs and Heat Emission for 38-in. Radiators
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No. 13-ZZ

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		Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam	R.C. Water	Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam	R.C. Water	Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam	R.C. Water		Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam or Water	Total B.T.U. Per Hr.	Rated Surface Sq. Ft.	E.D.R.—Sq. Ft.	B.T.U. Per Sq. Ft.	R.C. Steam or Water
1	2.5	1125	3	4.65	375	.66	.68	1580	4	6.56	397	.60	.62	1898	5	7.85	380	.60	.62	3	2557	8	10.62	329	.73	1628	4	6.74	407	.64
2	5.0	1849	6	7.65	308	.80	.83	2475	8	10.24	309	.77	.79	2955	10	12.23	296	.77	.80	6	4150	16	17.17	259	.91	2597	8	10.74	325	.80
3	7.5	2578	9	10.67	286	.83	.86	3373	12	13.96	281	.85	.87	4013	15	16.60	268	.85	.88	9	5730	24	23.71	239	.99	3558	12	14.72	297	.87
4	10.0	3307	12	13.68	276	.90	.93	4272	16	17.67	267	.89	.92	5070	20	20.98	254	.90	.93	12	7315	32	30.26	229	1.03	4520	16	18.70	283	.92
5	12.5	4035	15	16.69	269	.92	.95	5172	20	21.40	259	.92	.94	6128	25	25.35	245	.93	.96	15	8900	40	36.82	223	1.06	5480	20	22.67	274	.95
6	15.0	4765	18	19.71	265	.93	.96	6072	24	25.12	253	.94	.97	7185	30	29.73	240	.95	.98	18	10483	48	43.37	218	1.08	6439	24	26.64	268	.97
7	17.5	5494	21	22.73	262	.95	.98	6972	28	28.85	249	.95	.98	8243	35	34.10	236	.97	1.00	21	12069	56	49.93	216	1.09	7400	28	30.62	264	.98
8	20.0	6223	24	25.75	259	.95	.98	7869	32	32.56	246	.97	.99	9300	40	38.48	233	.98	1.01	24	13651	64	56.48	213	1.10	8361	32	34.60	261	.99
9	22.5	6950	27	28.75	257	.96	.99	8766	36	36.27	244	.98	1.00	10358	45	42.85	230	.99	1.02	27	15235	72	63.03	212	1.11	9326	36	38.58	259	1.00
10	25.0	7680	30	34.77	256	.97	1.00	9668	40	40.00	242	.98	1.01	11415	50	47.23	228	1.00	1.03	30	16816	80	69.57	210	1.12	10284	40	42.55	257	1.01
11	27.5	8405	33	34.79	255	.97	1.00	10567	44	43.72	240	.99	1.02	12473	55	51.61	227	1.01	1.04	33	18396	88	76.11	209	1.13	11242	44	46.51	256	1.01
12	30.0	9137	36	37.80	254	.97	1.00	11467	48	47.44	239	1.00	1.02	13530	60	55.98	226	1.01	1.04	36	19978	96	82.66	208	1.13	12206	48	50.50	254	1.02
13	32.5	9867	39	40.82	253	.98	1.01	12367	52	51.17	238	1.00	1.03	14587	65	60.35	224	1.02	1.05	39	21570	104	89.20	207	1.14	13165	52	54.47	253	1.02
14	35.0	10594	42	43.83	252	.98	1.01	13266	56	54.89	237	1.00	1.03	15645	70	64.73	224	1.02	1.05	42	23158	112	95.70	207	1.14	14129	56	58.46	252	1.03
15	37.5	11322	45	46.84	252	.98	1.01	14164	60	58.60	236	1.01	1.03	16703	75	69.11	223	1.03	1.06	45	24732	120	102.33	206	1.14	15086	60	62.41	251	1.03
16	40.0	12053	48	49.87	251	.98	1.01	15062	64	62.32	235	1.01	1.04	17760	80	73.48	222	1.03	1.06	48	26330	128	108.96	206	1.15	16045	64	66.38	251	1.03
17	42.5	12781	51	52.89	251	.99	1.02	15960	68	66.05	235	1.01	1.04	18817	85	77.85	221	1.03	1.06	51	27921	136	115.52	205	1.15	17007	68	70.36	250	1.04
18	45.0	13511	54	55.90	250	.99	1.02	16859	72	69.79	234	1.01	1.04	19872	90	82.22	221	1.03	1.07	54	29506	144	122.08	205	1.15	17971	72	74.35	250	1.04
19	47.5	14239	57	58.91	250	.99	1.02	17758	76	73.47	234	1.02	1.04	20936	95	86.62	220	1.04	1.07	57	31084	152	128.64	205	1.15	18932	76	78.33	249	1.04
20	50.0	14964	60	61.91	249	.99	1.02	18656	80	77.19	233	1.02	1.05	21990	100	90.98	220	1.04	1.07	60	32652	160	135.09	204	1.15	19828	80	82.28	249	1.04
		5½" Wide				1.08	1.12	8½" Wide				1.04	1.07	10" Wide				1.08	1.03		11½" Wide				1.03	8½" Wide				1.14

Radiation Computing—38-in. Radiators.

For 38-In. Radiators

RADIATION COMPUTING—THE REYNOLDS TABLES
Comparative Costs and Heat Emission for 45-in. Radiators
Steam Temp. 215° F. Room Temp. 70° F.

No. of Sections	Length	2 Col. Total B.T.U. Per Hr.	2 Col. Rated Surface Sq. Ft.	2 Col. E.D.R.–Sq. Ft.	2 Col. B.T.U. Per Sq. Ft.	2 Col. R.C. Steam	2 Col. R.C. Water	3 Col. Total B.T.U. Per Hr.	3 Col. Rated Surface Sq. Ft.	3 Col. E.D.R.–Sq. Ft.	3 Col. B.T.U. Per Sq. Ft.	3 Col. R.C. Steam	3 Col. R.C. Water	Length	4 Col. Total B.T.U. Per Hr.	4 Col. Rated Surface Sq. Ft.	4 Col. E.D.R.–Sq. Ft.	4 Col. B.T.U. Per Sq. Ft.	4 Col. R.C. Steam or Water	2 Col. Hospital Total B.T.U. Per Hr.	2 Col. Hospital Rated Surface Sq. Ft.	2 Col. Hospital E.D.R.–Sq. Ft.	2 Col. Hospital B.T.U. Per Sq. Ft.	2 Col. Hospital R.C. Steam or Water	No. of Sections
1	2.5	1892	5	7.89	378	.66	.68	2241	6	9.27	374	.65	.67	3	3092	10	12.79	309	.81	1966	5	8.13	393	.70	1
2	5.0	2975	10	12.31	298	.84	.87	3480	12	14.40	290	.83	.86	6	5000	20	20.69	250	1.00	3118	10	12.99	312	.88	2
3	7.5	4059	15	16.79	271	.93	.95	4720	18	19.53	262	.92	.95	9	6909	30	28.59	230	1.08	4271	15	17.67	285	.96	3
4	10.0	5142	20	21.27	257	.98	1.00	5959	24	24.65	248	.97	1.00	12	8816	40	36.47	220	1.13	5424	20	22.44	271	1.01	4
5	12.5	6225	25	25.76	249	1.01	1.04	7197	30	29.78	240	1.01	1.04	15	10725	50	44.37	215	1.16	6575	25	27.20	263	1.04	5
6	15.0	7308	30	30.24	244	1.03	1.06	8435	36	34.90	234	1.03	1.06	18	12636	60	52.28	211	1.18	7725	30	31.96	258	1.06	6
7	17.5	8398	35	34.71	240	1.05	1.08	9677	42	40.04	230	1.05	1.08	21	14539	70	60.15	208	1.20	8875	35	36.72	254	1.08	7
8	20.0	9476	40	39.21	237	1.06	1.09	10915	48	45.16	228	1.06	1.09	24	16445	80	68.04	206	1.21	10028	40	41.49	251	1.09	8
9	22.5	10562	45	43.70	235	1.07	1.10	12155	54	50.29	225	1.07	1.11	27	18360	90	75.96	204	1.22	11183	45	46.27	249	1.10	9
10	25.0	11645	50	48.18	233	1.08	1.11	13392	60	55.41	223	1.08	1.12	30	20270	100	83.86	203	1.23	12335	50	51.03	247	1.11	10
11	27.5	12727	55	52.66	231	1.09	1.11	14632	66	60.54	222	1.09	1.12	33	22176	110	91.75	202	1.23	13487	55	55.80	245	1.12	11
12	30.0	13810	60	57.14	230	1.09	1.12	15872	72	65.67	220	1.09	1.13	36	24084	120	99.64	201	1.24	14640	60	60.57	244	1.12	12
13	32.5	14892	65	61.61	229	1.10	1.13	17113	78	70.80	219	1.10	1.14	39	25987	130	107.52	200	1.24	15789	65	65.32	243	1.13	13
14	35.0	15974	70	66.09	228	1.10	1.13	18354	84	75.94	219	1.10	1.14	42	27902	140	115.44	199	1.25	16940	70	70.09	242	1.13	14
15	37.5	17058	75	70.58	227	1.10	1.13	19593	90	81.06	218	1.11	1.14	45	29805	150	123.31	199	1.25	18090	75	74.84	241	1.14	15
16	40.0	18143	80	75.06	227	1.11	1.14	20832	96	86.19	218	1.11	1.15	48	31712	160	131.20	198	1.26	19248	80	79.64	241	1.14	16
17	42.5	19227	85	79.55	226	1.11	1.14	22068	102	94.30	216	1.11	1.15	51	33626	170	139.12	198	1.26	20400	85	84.40	240	1.14	17
18	45.0	20311	90	84.03	226	1.11	1.14	23306	108	96.43	216	1.12	1.15	54	35537	180	138.75	197	1.26	21551	90	89.16	240	1.14	18
19	47.5	21394	95	88.51	225	1.12	1.15	24544	114	101.55	216	1.12	1.16	57	37430	190	154.86	197	1.26	22705	95	93.94	239	1.15	19
20	50.0	22478	100	93.00	225	1.12	1.15	25776	120	106.64	215	1.12	1.16	60	39340	200	162.76	197	1.27	23850	100	98.68	239	1.15	20
		8½" Wide				1.10	1.13	10" Wide				1.06	1.09		11½" Wide				1.09	8½" Wide				1.20	

Radiation Computing—45-in. Radiators. No. 13-ZZ1

For 45-In. Radiators

RADIATION COMPUTING—THE REYNOLDS TABLES
Comparative Costs and Heat Emission for Wall and Window Radiators
Steam Temp. 215° F. Room Temp. 70° F.

No. of Sections	Wall-5A-13" Total B.T.U. Per Hr.	Wall-5A-13" Rated Surface Sq. Ft.	Wall-5A-13" E.D.R.–Sq. Ft.	Wall-5A-13" B.T.U. Per Sq. Ft.	Wall-5A-13" R.C.-Steam-Water	Wall-7B-22" Total B.T.U. Per Hr.	Wall-7B-22" Rated Surface Sq. Ft.	Wall-7B-22" E.D.R.–Sq. Ft.	Wall-7B-22" B.T.U. Per Sq. Ft.	Wall-7B-22" R.C.-Steam-Water	Wall-9B-29" Total B.T.U. Per Hr.	Wall-9B-29" Rated Surface Sq. Ft.	Wall-9B-29" E.D.R.–Sq. Ft.	Wall-9B-29" B.T.U. Per Sq. Ft.	Wall-9B-29" R.C.-Steam-Water	Length	Window-13" Total B.T.U. Per Hr.	Window-13" Rated Surface Sq. Ft.	Window-13" E.D.R.–Sq. Ft.	Window-13" B.T.U. Per Sq. Ft.	Window-13" R.C.-Steam-Water	Window-16" Total B.T.U. Per Hr.	Window-16" Rated Surface Sq. Ft.	Window-16" E.D.R.–Sq. Ft.	Window-16" B.T.U. Per Sq. Ft.	Window-16" R.C.-Steam-Water	Window-20" Total B.T.U. Per Hr.	Window-20" Rated Surface Sq. Ft.	Window-20" E.D.R.–Sq. Ft.	Window-20" B.T.U. Per Sq. Ft.	Window-20" R.C.-Steam-Water	No. of Sections
1	1658	3	6.86	332	.93	2234	7	9.24	319	.82	2853	9	11.80	317	.82	3	1082	3	4.48	361	1.03	1992	3.75	5.51	355	.99	1708	5	7.07	342	.95	1
2	3208	10	13.27	321	.96	4281	14	17.71	306	.85	5456	18	22.57	303	.86	6	1762	6	7.29	294	1.26	2156	7.50	8.92	288	1.22	2761	10	11.42	276	1.17	2
3	4758	15	19.69	317	.97	6327	21	26.18	301	.86	8059	27	33.34	299	.87	9	2441	9	10.10	271	1.37	2979	11.25	12.33	265	1.32	3816	15	15.79	254	1.27	3
4	6308	20	26.10	315	.98	8372	28	34.64	299	.87	10663	36	44.12	296	.88	12	3119	12	12.90	260	1.42	3803	15.00	15.73	254	1.38	4872	20	20.16	244	1.39	4
5	7860	25	32.52	314	.98	10420	35	43.11	298	.87	13266	45	54.89	295	.88	15	3798	15	15.71	253	1.46	4626	18.75	19.14	247	1.42	5930	25	24.53	237	1.36	5
6	9408	30	38.92	314	.98	12466	42	51.58	297	.88	15869	54	65.66	296	.88	18	4477	18	18.52	249	1.49	5450	22.50	22.55	242	1.46	6987	30	28.91	233	1.39	6
7	10959	35	45.34	313	.98	14513	49	60.05	296	.88	18472	63	76.43	293	.89	21	5156	21	21.33	246	1.51	6274	26.25	25.96	239	1.46	8043	35	33.28	230	1.41	7
8	12508	40	51.75	313	.98	16559	56	68.51	296	.88	21074	72	87.19	293	.89	24	5836	24	24.15	243	1.52	7098	30.00	29.37	237	1.48	9098	40	37.64	227	1.42	8
9	14063	45	58.18	313	.99	18604	63	76.97	295	.88	23676	81	97.96	292	.89	27	6516	27	26.96	241	1.54	7921	33.75	32.77	235	1.49	10152	45	42.00	226	1.43	9
10	15610	50	64.58	312	.99	20650	70	85.44	295	.88	26280	90	108.73	292	.89	30	7198	30	29.76	240	1.54	8745	37.50	36.18	233	1.50	11210	50	46.38	224	1.44	10
11	17610	55	72.00	312	.99	22706	77	93.92	295	.88	28888	99	119.52	292	.89	33	7871	33	32.57	239	1.58	9570	41.25	38.59	232	1.51	12265	55	50.74	223	1.45	11
12	18708	60	77.40	312	.99	24670	84	102.38	295	.88	31493	108	130.30	292	.89	36	8550	36	35.37	238	1.56	10395	45.00	42.01	231	1.51	13326	60	55.11	222	1.45	12
13	20261	65	83.83	312	.99	26700	91	110.86	294	.88	34096	117	141.06	291	.89	39	9227	39	38.18	237	1.56	11217	48.75	44.41	230	1.52	14378	65	59.49	221	1.46	13
14	21812	70	90.24	312	.99	28832	98	119.29	294	.88	36696	126	151.82	291	.89	42	9908	42	40.99	236	1.57	12038	52.50	47.81	229	1.53	15435	70	63.86	221	1.46	14
15	23363	75	96.66	312	.99	30881	105	127.77	294	.88	39299	135	162.59	291	.89	45	10589	45	43.81	235	1.57	12864	56.25	53.22	229	1.53	16600	75	68.23	220	1.47	15
16	24913	80	103.07	311	.99	32928	112	136.23	294	.88	41904	144	173.37	291	.89	48	11266	48	46.61	235	1.58	13686	60.00	56.62	228	1.53	17594	80	72.59	219	1.47	16
17	26461	85	109.48	311	.99	34976	119	144.70	294	.88	44508	153	184.15	291	.89	51	11944	51	49.42	234	1.58	14509	63.75	60.03	228	1.54	18796	85	76.95	219	1.48	17
18	28008	90	115.88	311	.99	37019	126	153.16	294	.89	47110	162	194.91	291	.89	54	12625	54	52.23	234	1.58	15336	67.50	63.45	227	1.54	19953	90	81.32	218	1.48	18
19	29560	95	122.30	311	.99	39062	133	161.16	294	.89	49715	171	205.69	291	.89	57	13306	57	55.04	233	1.59	16164	71.25	66.86	227	1.54	20776	95	85.68	218	1.48	19
20	31110	100	128.71	311	.99	41118	140	170.12	294	.89	52322	180	216.47	291	.89	60	13986	60	57.87	233	1.59	16992	75.00	70.29	227	1.54	21776	100	90.07	218	1.48	20
	17" Wide x 3" Thick				1.35	13" Wide x 3" Thick				1.14	13" Wide x 3" Thick				1.14		12½" Wide				1.62	12½" Wide				1.53	12½" Wide				1.41	

Radiation Computing—Wall and Window Radiators. No. 13-ZZ2

For Wall and Window Radiators

(2197)

¶ Bureau of Standards Laboratories. ¶ Agricultural Department Laboratories. ¶ United States Government Buildings, Washington, D. C. ¶ Uniform temperatures essential to scientific investigations carried on in these buildings.

Performance—not claims—won here

After a thorough investigation the Powers System of Temperature Control was installed in these buildings—the sole determining factor being ACCURACY and DEPENDABILITY of control.

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Excessive use of compressed air in a temperature regulating system introduces large quantities of dust and moisture into the system which results in clogging, and corrosion of air lines and mechanism. These troubles, which cause inaccurate control and frequent repairs, are eliminated in the Powers System. It uses 90 per cent less air than other systems. In Powers Thermostats there are no finely restricted air passages or leak ports, no motion multiplying devices which need frequent adjustment and repair.

This is only one of the fundamental differences between Powers systems and Low First Cost Systems of Control and accounts for the practically perfect performance of the Powers System.

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A Powers System commonly gives 18 to 25 years of ACCURATE, DEPENDABLE Service, with practically no expense for repairs or adjustments. Our booklet, "The Elimination of Heat Waste" shows how and why Powers Systems are "lowest in cost per year." May we send you a copy?

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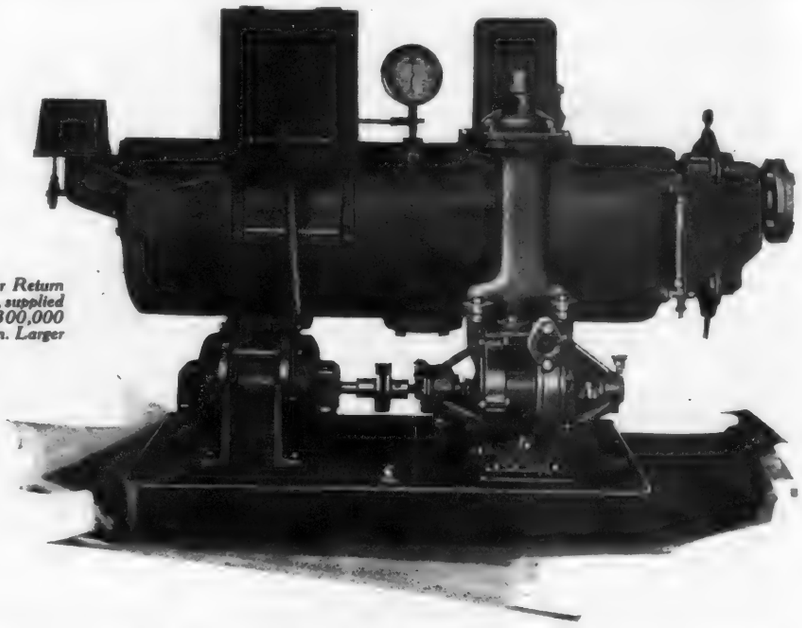
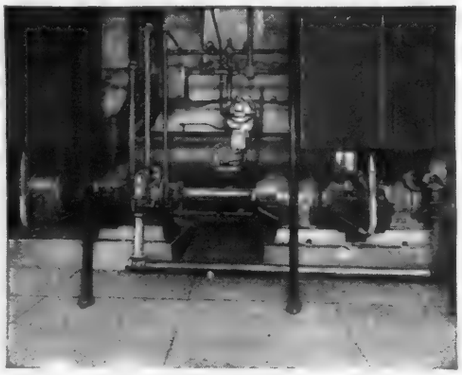


Motor-Driven Jennings Hytor Return Line Vacuum Heating Pump, supplied in standard sizes suitable for 300,000 sq. ft. equivalent direct radiation. Larger sizes when so ordered.

No metal-to-metal contact in this heating pump

Typical Installation of Jennings Vacuum Pumps and Jennings Condensation Pumps.



Two Motor-Driven Jennings Vacuum Pumps with automatic control.

that is why it gives unfailing performance season after season

In the Jennings Hytor Return Line Vacuum Heating Pump, the air and water pump impellers are firmly secured to the same shaft and rotate as a single unit. The peripheral clearance between the impellers and the casings in which they revolve is large. There is no metal-to-metal contact that will cause the pump to wear out, resulting in a decrease in vacuum. Neither are there any complicated parts or mechanisms likely to get out of order.

That is why the Jennings Pump lasts season after season, and always gives the dependable performance for which it is well-known.

High efficiency constantly maintained makes the Jennings Pump unsurpassed in the several uses for which it is recommended.

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Jennings Hytor

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

2040-88

Trade and Miscellaneous Notes

Coming Events

May 19-22, 1925.—Sixteenth annual convention of the National District Heating Association at West Baden, Ind. Headquarters at West Baden Hotel.

May 26-28, 1925.—Annual meeting of the National Pipe and Supply Association at French Lick, Ind.

June 1-4, 1925.—Thirty-sixth annual convention of the Heating and Piping Contractors National Association at Detroit, Mich. Headquarters at the new Book-Cadillac Hotel.

June 15-17, 1925.—Semi-annual meeting of the American Society of Heating and Ventilating Engineers in Atlantic City, N. J. Headquarters at Hotel Traymore.

Miscellaneous Notes

American Engineering Standards Committee reports that American business, big and little, is organizing to put all of its power and prestige back of the standardization movement, and to facilitate and expedite the extensive, nationwide work in this direction. The first step in this campaign to give impetus to the united industrial effort against waste and for the quickening of trade is the formation of a committee of five executives to act as an advisory body to the American Engineering Standards Committee. This committee is composed of J. A. Farrell, president of the U. S. Steel Corporation; G. B. Cortelyou, president of the Consolidated Gas Company, New York; J. W. Lieb, vice-president of the New York Edison Company; L. F. Loree, president of the Delaware & Hudson Company, and Gerard Swope, president of the General Electric Company.

National Fire Protection Association at its annual meeting at Chicago, May a number of minor revisions in the Regulations for Blower Systems for Heating and Ventilating, Stock and Refuse Conveying.

Exposition of Modern Decorative and Industrial Art, which opens in Paris in May, will be attended by a number of delegates representing the architectural, building and other allied art industries of the United States who will accompany the commission appointed by Secretary Herbert Hoover of the Department of Commerce. Among the delegates are Noble Foster Hoggson of Hoggson Brothers, New York, representing the American Construction Council, and Adolph Mueller of the Mueller Company, Decatur, Ill., representing the National Association of Manufacturers.

Washington.—Although the United States has within its borders the largest supply of fuel in the world, including oil, natural gas and coal, nothing will be left within a few decades except the coal, declares an exhaustive report prepared by a committee of experts for submission to the third biennial meeting of the International Chamber of Commerce at Brussels, June 21-27. It is pointed out in the report that "imports, if possible, of liquid fuels may postpone their exhaustion for several decades, but it seems quite probable that by the year 1950 much the greater part of the natural liquid and gaseous fuels will have practically disappeared. Present methods of using coal are wasteful; new methods, are becoming more and more urgent, the vast resources of fuel in oil-shale reserves several times greater than those of petroleum, are untapped, awaiting the time when they can be mined and marketed economically.

The committee which drafted the report was composed of Arthur D. Little, chairman, Boston; W. T. Coe, man-

Pure Air Eliminates "Spring Fever"

Spring with its myriads of flowers and sunshine carries the call of the great out-o'-doors to the factory, office, store and shop.

Not everyone can enjoy Mother Nature's green but all can benefit by the fresh clean air of early Springtime.

Assist your clients in speeding production and eliminating "Spring Fever" by specifying Autovent Ventilating Equipment.

ACTIVE SALES OFFICES AND BRANCHES IN ALL PRINCIPAL CITIES

AUTOVENT FAN & BLOWER CO.
730-738 W. MONROE ST., CHICAGO

ager of the Consolidation Coal Company, London; C. E. Lesher, editor, Coal Age, New York; Van H. Manning, director, Research Department, American Petroleum Institute, New York; George Otis Smith, director, United States Geological Survey, Washington; and Thomas H. Watkins, president, Pennsylvania Coal and Coke Corporation, New York.

Radical changes in the use of fuel, necessitated by the approaching exhaustion of the domestic petroleum supplies are foreseen by the committee. The directions in which developments may come, as outlined tentatively by the committee, include: Use of coal at the mines, there to be subjected to complete gasification or to carbonization, with complete by-product recovery; the gas which results to be transmitted under high pressure to the point of use where this point is not too distant and the coke to be used for the generation of electricity, to be transmitted at high tension to the point of use. Under this arrangement shipments from the mine plant would be mainly in the form of coke or coke briquettes.

Domestic heating from central plants or by gas or coke.

Abandonment of the use of petroleum products for domestic heating, for industrial uses, and for fuel on railroads.

Development of the shale-oil industry.

Large steam plants to have coal processing plants connected with them, coke being burned as fuel, gas distributed as fuel for domestic and industrial uses, and with full by-product recovery. Exhaust steam to be used for domestic heating as far as possible.

Abandonment as far as possible of small gas plants. "Foolish antiquated standards for heating requirements abandoned."

Brooklyn "Own Your Home" Show was held at the 23rd Regiment Armory, March 29-April 4. Among the exhibits were two types of the Par-X-Oil Burners and two types of Richardson & Boynton water-heating boilers, Bryant gas-fired steam boilers, A. H. Wolff gas heaters, Ideal gas-fired steam boilers, Minneapolis heat regulators and Honeywell temperature regulators.

Milwaukee's Third Annual "Own Your Home" Show was held at the Milwaukee Auditorium, March 28-April 4, under the auspices of the Milwaukee Real Estate Board. Among the exhibitors were the Automatic Burner Company, Combustion Fuel Oil Burner Company, Domestic Oil Burner Company, Johnson Oil Burner Company, Kerrihard Oil Burner Company, Meadows Heating Company, Minneapolis Heat Regulator Company, Rayfield Oil Burner Company and the Rotary Company.

Southern Exposition, which will go on at the Grand Central Palace, New York, May 11-23, is described as a co-operative enterprise endorsed by the governors, chambers of commerce, transportation companies, industrial concerns and leading men of the South. The exhibition will occupy three floors of the Grand Central Palace. Each State will be assigned a special day.

Building Operations during March, 1925, showed an increase of 11% over the corresponding month of last year, according to figures issued by the F. W. Dodge Corporation. Building contracts awarded last month in the 36 eastern States amounted to $480,916,300 as compared with $433,340,300 in March, 1924. The increase over February this year was 61%. It should be stated, however, that the most conspicuous feature of the March record was a contract for a $30,000,000 electric power development in West Virginia which accounted for most of the increase over the previous March. This project brought the total of industrial work for the month up to $53,133,000, or 11% of all new construction started during the month. Public works and utilities projects continue to increase. Last month they amounted to $67,931,000, or 14% of the total. Educational buildings, amounting to $42,192,900, or 9% of the total, also increased over last March. Residential buildings, although amounting to 46% of last month's total, or $220,872,100, fell behind the previous March; and commercial buildings fell behind, too, amounting to $54,871,100, or 11% of the total.

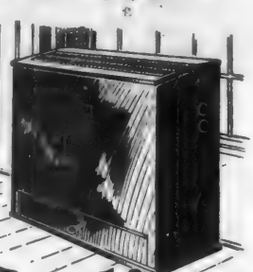
THE picture shows Public School No. 210, Brooklyn, N. Y.—*the first New York City school to be completely equipped with the Unit System of ventilation.* This is the new standardized type of school building—with 84 Peerless Units.

The Peerless Unit System insures thorough ventilation for each room independently, without drafts. It is noiseless, easy to operate, and absolutely dependable. Adaptable to all steam systems; no remodeling required for old buildings.

Send for Catalogue

Peerless Unit Ventilation Co., Inc.,
Skillman Ave. and Hulst St., Long Island City, N. Y.

PEERLESS
UNIT SYSTEM
Heating and Ventilating



Overcoming difficulties

WHERE working conditions have been most difficult the merit of the Johns-Manville Underground System of Insulation has been most apparent.

Up hill and down dale, through congested city districts, over streams, through quicksand and through rock and in the face of many other obstacles, installations of the Johns-Manville System for preventing radiation and loss of heat from pipes running underground, have revealed its basic high quality and the skill and ingenuity of the men who are responsible for its installation.

JOHNS-MANVILLE, Inc.
292 Madison Avenue at 41st Street, New York City
Branch in 62 Large Cities
For Canada: CANADIAN JOHNS-MANVILLE CO., Ltd. Toronto.

12-inch high pressure steam main and 8-inch return climb a steep hill. The grade was brought up to cover after installation.

Like the New York Subway, the Johns-Manville Underground System of Insulation does not always stay underground. At Cornell University it crosses a creek.

Quicksand and numerous springs made trench digging difficult here.

Through—
Electrical Materials
FOR
Utilities
Jobber
Contractor
AND
Dealer

JOHNS-MANVILLE

Underground System of Insulation

Cost Analysis of Heating and Plumbing Supplies will be made by the Bureau of Business Research of New York University for the Eastern Supply Association, according to an announcement by the director, Dr. Lewis H. Haney. Contacts have been established by the director and staff of the Bureau with several hundred distributors of heating and plumbing supplies. As soon as the desired information on costs is tabulated and analyzed it will be used as a basis for a report on the many items of costs that enter into the successful conduct of business in this field.

Engineering Institute of Canada has appointed Richard John Durley to the position of secretary. He has already assumed office. Mr. Durley was formerly a professor of mechanical engineering in McGill University. During the war he did notable service in the Division of Gauges and Standards. In 1919 he was appointed secretary of the Canadian Engineering Standards Association.

Carnegie Institute of Technology, Pittsburgh, announces special courses in heating and plumbing during the coming summer. According to the announcement, courses of six and eight weeks beginning June 15 and June 29, will be given by the Department of Plumbing, Heating and Ventilation in heating, plumbing and oxy-acetylene welding. Special emphasis, it is stated, will be placed upon advanced courses in heating and plumbing, arranged with special reference to those in the contracting business.

American Engineering Standards Committee reports that its Sectional Committee on the Standardization of Pipe Flanges and Fittings has approved by a practically unanimous vote for the submission to the sponsor organizations (American Society of Mechanical Engineers, Manufacturers Standardization Society of the Valve and Fittings Industry, and Heating and Piping Contractors National Association), a number of important standards applying to malleable-iron screwed fittings, and cast-iron, as follows:

For malleable-iron screwed fittings, 150 lbs. per square inch working steam pressure; Crosses, tees, 90° and 45° ells, straight and reducing; Street ells 90° and 45° and service tees straight and reducing.

Caps: Open-pattern return bends; 45° Y's, straight and reducing.

Couplings: Medium-pattern return bends; Close-pattern return bends.

For cast-iron screwed fittings, 125 and 250 lbs. per square in working steam pressure: Crosses, tees, 90° and 45° ells, straight and reducing.

Manufacturers' Notes

Richardson & Boynton Co., New York, announces the adoption of an installment or time-payment plan by which dealers and customers may pay for their heating plants on a monthly basis. According to the plan, cash payments may be made from 20% to 25% of the total amount of the contract. The remaining payments are extended over a period of months. Interest charges are added, making it an inducement for the purchaser to complete his payments as fast as possible.

Walworth Mfg. Co., Boston, Mass., has established an Engineering Products Division which will co-operate with the production, engineering and sales departments. J. M. Olmstead has been appointed general manager of the new division with headquarters in Chicago, and F. W. Duemler, assistant manager with offices in New York City.

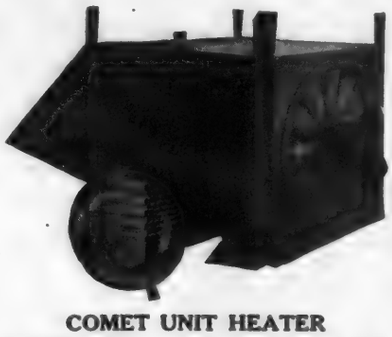
Williams Oil-O-Matic Heating Corp., Bloomington, Ill., marked the end of another instruction term in its campaign to educate dealers in methods of using fuel oil with a dinner at the Empire Hotel, New York, March 27. This instruction has been in charge of Chester J. Scanlan. H. C. Lefler is the Eastern divisional manager of the comany. A similar sales and service school for the Eastern division was conducted at the Central Y. M. C. A., Philadelphia, March 16-20. The course was under the supervision of Messrs. Scanlan, Pledger and Nesmith. The course closed with a dinner at the Hotel Adelphia, March 20.

WHY LET THAT UNHEATED BUILDING WORRY YOU

We manufacture Unit Heaters and Fan Heating Systems for every need. If steam is not available, our all steel direct fired Fan Furnace will meet your requirments.

Send us your heating problems and we will show you the easiest and cheapest way.

Recommendations and prices furnished cheerfully without cost to you.



COMET UNIT HEATER

Suitable for use where steam and hot water is available. This Heating Ace is especially adapted where compactness and lightness in weight is of importance. For complete description write for Bulletin No. 85.

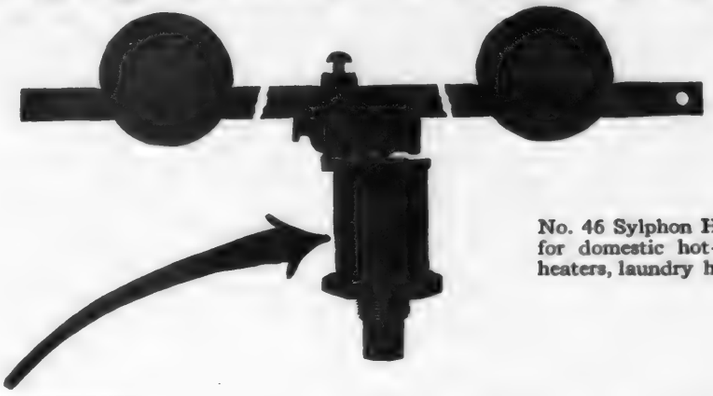
DIRECT FIRED FAN FURNACE

For use where steam or hot water is not available. For complete data write for Bulletin No. 90.

THE NEW YORK BLOWER COMPANY

CHICAGO, ILL. *Branch Offices in Principal Cities* LA PORTE, IND.

A New Sylphon Hot-Water Regulator



No. 46 Sylphon Hot-Water Regulator for domestic hot-water supply tank heaters, laundry heaters, garages, etc.

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL SEAMLESS SYLPHON BELLOWS
Sylphon

A life time of control guaranteed by the Sylphon Bellows

This new No. 46 Sylphon Hot-Water Damper Regulator is built around the marvelous, seamless, Sylphon bellows. Drawn from a flat sheet of metal, *without soldered seams,* and used as the expansion member, it guarantees a life-time control of the Regulator. The diagrammatic cut graphically illustrates the extreme flexibility of the bellows.

Trade Data on the New No. 46 Sylphon Hot-Water Regulator

Hub of Regulator threaded 1″ standard pipe size. Bulb 1″ long; lever bar 40″ long; adjusting weights (2) 3 lbs. each. Will control water from 130° F. to 200° F. Can be temporarily exposed to 220° F. without injury. Shipped with 8 ft. of chain; 8 ft. of wire cable; 4 S-hooks; 2 ceiling pulleys; lever bar and 2 weights. List price, $16.00

New discounts on Sylphon Heating Specialties effective April 1, 1925. Have you received your copy?

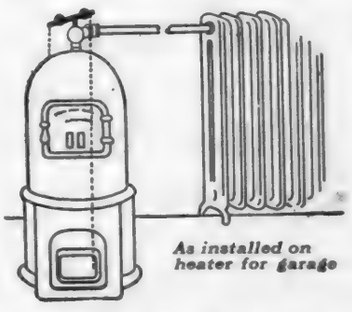
Sylphon
Hot-water Damper Regulator

Just what Heating Contractors have wanted!

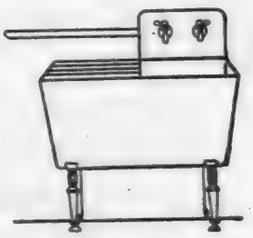
TIME and again, Contractors have said to us, "Build us a Sylphon Hot-Water Regulator that will have the accurate control of all your instruments and be small enough to go on laundry heaters, small domestic hot-water supply tank heaters, etc."

We have done as they asked, and now present the No. 46 Sylphon Hot-Water Damper Regulator.

Controls small quantities of hot water



As installed on heater for garage



As installed on heater for laundry and other hot-water requirements

In this No. 46, you have a small, compact Regulator that will handle temperatures up to 200°F., and with a 1″ bulb will screw directly into small domestic hot-water supply tank heaters. With a *genuine* Sylphon bellows as its diaphragm, it will last as long as any heater made and always open and close drafts evenly and positively.

Let us send you Bulletin WDR on No. 46 and other Damper Regulators.

THE FULTON COMPANY KNOXVILLE, TENN.

ORIGINATORS AND PATENTEES OF THE SYLPHON BELLOWS

Sales offices in: NEW YORK, CHICAGO, DETROIT, BOSTON, PHILADELPHIA, *and all the principal cities in U. S.*
European representatives: Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. I., England
Canadian representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

J. B. Wise, Inc., Watertown, N. Y., announces that William A. Brecht, the company's general sales manager, has been made vice-president, and William M. Thompson, formerly western sales manager, has been made general sales manager.

Hoffman Specialty Co., New York, reports sales on Hoffman valves for the first three months of 1925 as marking another record, exceeding the best previous mark for a similar quarter by 15%.

Federal Gauge Co., Chicago, Ill., manufacturers of Federal gauges and Mercoid controls, has taken additional space at its present quarters, 564 West Adams Street, to provide for the increase in the company's business.

Vapor Heating Co., Philadelphia, Pa., has appointed P. Alfred Croney, branch office manager in charge of the Philadelphia branch. Mr. Croney is well known as a heating and electrical engineer of Philadelphia. The Philadelphia office has been enlarged to accommodate the company's increased business. Announcement is also made by the company of the appointment of R. W. O'Brien as branch office manager for Buffalo. Mr. O'Brien is also well known as a heating engineer, especially in western New York and northern Pennsylvania.

Kewanee boiler installations in schools and colleges, industrial plants and warehouses, greenhouses, hospitals and sanitariums, banks, country clubs, railroad properties, residences, lodges and fraternities, garages, business blocks, churches and convents, apartment buildings, etc., constitute an impressive list occupying a twenty-four page edition of the *Kewanee Daily Star-Courier* for April 7, 1925. The list, comprising some 18,000 installations, includes data covering the location, name, heating contractor, number and size of each boiler.

McDonnell & Miller, Chicago, Ill., manufacturers of the McDonnell duplex water feeders, announces their removal to 1344 North Section, Wrigley Bldg., Chicago.

Fitzgibbons Boiler Co., Oswego, N. Y., is enlarging its Oswego plant with a view of doubling its present capacity. President Homer Addams of the Fitzgibbons Boiler Company was a guest of honor and the principal speaker at a recent dinner of the Oswego Chamber of Commerce, when plans for the enlargement of the company's factory were announced. The first unit of the enlarged plant will be a boiler shop built of steel and concrete and will be equipped with labor-saving machinery for the manufacture of the company's several types of boilers for high and low pressure. The company's business, it is announced, has quadrupled in a period of three and one-half years.

McCann-Harrison Corp., Cleveland, O., engineers for industrial air heaters, announces the appointment of George Schmidt as its New York representative, with offices at 165 Broadway.

Murphy Plumbing Co., Chicago, Ill., and its auxiliary, the Hardinge Fuel Oil Heating Company, whose main offices for the past twenty years have been at 23 East Congress Street, have removed to 1720 South Michigan Boulevard, where the quarters comprise a three-story and basement building 25 ft. by 172 ft., on which the company has taken a long term lease. The new location has a floor area of over 17,000 sq. ft. At the same time the Boulevard store will permit the company to display, to advantage the Hardinge fuel oil burner. A burner of this type is being used to heat the new building.

Oster Mfg. Co., Cleveland, O., manufacturers of pipe-threading tools and machines, held a three-day assembly of salesmen and factory executives at its plant in Cleveland, March 16-18.

Kewanee Boiler Co., Kewanee, Ill., announces a new sales and display rooms for its San Francisco branch at 635 Mission Street, San Francisco. The company also announces a new size boiler of the small riveted-steel type, designed especially for service in small apartment buildings in California.

Boiler and Radiator Corp., Rochester, N. Y., announces the removal of its offices from 154 East Avenue, to its

SELF OILING BEARINGS

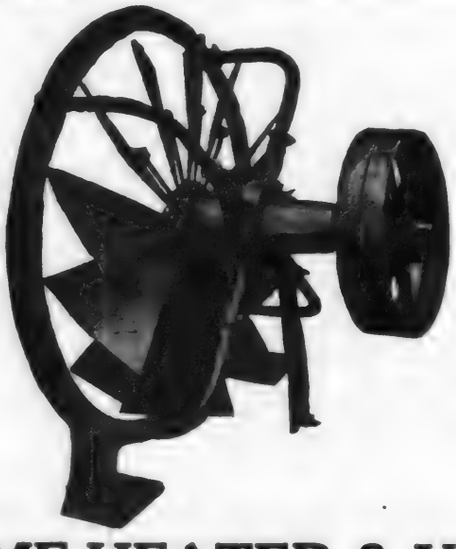
AN EXCLUSIVE AND PATENTED FEATURE OF

Supreme Multiblade Disc Fans

Successfully Applied to Mechanical Furnace Systems.

Drying, Cooling, Ventilation and General Factory Service.

PRICES SHOW SAVINGS OF 20 to 30%



Note accessibility of bearings—Located **outside** of fan—Positively dust proof.

The blade design is rendering efficient and economical operation under all conditions of service.

WRITE FOR CATALOG TODAY

SUPREME HEATER & VENTILATING CORP.

ENGINEERS AND MANUFACTURERS

ST. LOUIS, MO.

SALES ENGINEERS—Some desirable territory is open on this line

15-cent Fitting costs $15

WHEN a sand-hole in a fitting shows up after a piping installation is finished a 15-cent fitting may very easily cost $15. The labor cost of backing out the line and replacing a fitting is one reason we perfected a cast-iron fitting of our own. We use them by the scores of millions and, as our own requirements for sprinkler work are filled from exactly the same stock we sell to the trade, it pays us to take more than usual care to see that imperfect fittings never get into the stock line.

Grinnell Fittings are usually stocked by the same distributors that carry the famous Grinnell Hangers.

SEND for our booklet, "Only a Cast Iron Fitting" and Hanger Catalogue No. 3. They contain information that is vital to any man interested in piping installations of any kind. Write for both of them today. Address your request to Grinnell Company, Inc., 280 W. Exchange St., Providence, R. I.

GRINNELL

Fittings, Hangers, Valves, Pipe Bending, Welding, Piping Supplies, Etc.

warehouse at 999 East Main Street. The change has been made to provide better service by having the office and warehouse in one location. The company carries in stock a full line of Weil-McLain round and section boilers, steam and water, ranging in capacity up to 6,500 sq. ft., also radiation and heating specialties.

General Electric Co., Schenectady, N. Y., announces that following several years of development and trial it is now marketing a line of automatic arc-welding equipments. These equipments are sold as either complete units or as separate parts, and are especially designed for application in the construction of tanks, boilers, cans and pipe. The complete outfit consists of an automatic welding head and control panel, travel carriage and clamping device.

Dimock & Fink Co., New York., jobbers of heating and plumbing supplies, has purchased the jobbing business of John A. Murray & Company at 312 West 29th Street. It is stated that the John A. Murray & Company organization will be held practically intact and that the Dimock & Fink Company will use the West 29th Street salesroom and warehouse to take care of its trade in that section.

Honeywell Heating Specialties Co., Wabash, Ind., announces the opening of a Chicago branch office at Rooms 2101, Straus Building; manager, W. J. Hajek.

Trane Co., La Crosse, Wis., announces that J. K. Wells, engineer-salesman at the home office, has been transferred to the company's Greensboro, N. C. office.

O. E. Frank Heater & Engineering Co., Buffalo, N. Y., manufacturer of heaters, coolers, condensers and heat exchangers, announces the appointment of the following district representatives:

New York, George L. Fitz, 200 Fifth Avenue.
Philadelphia, Haynes Selling Co., Inc., 1711 Sansom St.
Cleveland, O., H. P. Rodgers, Leader News Building.
Pittsburgh, Power Equipment Co., 628 Oliver Building.
Baltimore, Md., Vance & Vance, 510 Garrett Building.
Washington, D. C., Vance & Vance, 616 Lenox Building.
Richmond, Va., Vance & Vance, 302 Carneal Building.
Roanoke, Va., 506 Boxley Building.
Charlotte, N. C., H. S. Hall, Inc., 208 Kinney Building.
Harrisburg, Pa., Irvin H. Geiger, 212 North 3rd St.
Kansas City, Mo., Steam Plant Equipment Co., 201 Mutual Building.
San Francisco, Cal., M. J. Haley, 593 Market St.

Trane Co., La Crosse, Wis., announces that its two new bulletins, one on Trane heating specialties and the other on Trane vacuum, condensation, circulating and similar pumps, will be of the standardized size of 8½ in. x 10⅝ in., recommended by the National Trade Extension Bureau, instead of the 6 in. x 9 in. size that has been used in the past.

International Heater Co., Utica, N. Y., announces its annual Spring cleaning campaign which has become an event much appreciated by the company's dealers who purchase Spring cleaning cards in large lots in connection with this campaign. To further the campaign the company has issued an attractive broadside to the trade, with Spring cleaning as the keynote.

Pacific Boiler Co., Inc., of New York, has been organized to continue the active distribution throughout the eastern district of the Pacific low-pressure portable firebox steel boiler previously distributed by the General Boilers Company, Waukegan, Ill. There will be no change it is announced, in the personnel of the selling organization. President, A. H. Christian; secretary, J. Edgar Titzell.

Hoffman Specialty Co., New York, has appointed George H. Padginton district sales representative of the company, covering territory within the vicinity of Buffalo, N. Y. Mr. Padginton's headquarters will be at 679 Norfolk Avenue, Buffalo. The Hoffman Specialty Company also announces the appointment of C. I. Connolly as its representative in North Carolina, Virginia and District of Columbia, with headquarters at 1716 Floyd Avenue, Richmond, Va.

Utica Heater Co., Utica, N. Y., announces the removal of its Chicago office to 363-365 East Illinois Street, Chicago. The office continues under the direction of Vice-President James Doherty, Manager Albert F. Hen and Assistant Manager Russell Doherty selling, in the Chicago territory, Utica-Imperial super-smokeless boilers, Lincoln radiators and Superior new idea and Essex warm-air furnaces.

Central Station Heating Notes

Vancouver, B. C.—University of British Columbia has called for bids for the erection of a central heating plant to supply its eleven buildings. The plant will include 13,000 ft. of insulating pipe and the estimated cost is 150,000.

Miles City, Mont.—The State Board of Education of Montana has been asked to appropriate sufficient funds to cover the installation of a new central heating plant for the Montana State Industrial School at Miles City.

Passaic, N. J.—The Passaic General Hospital, R. J. Scholes, president, is planning the construction of a central heating and power plant to cost $500,000.

Rochester Gas & Electric Co., Rochester, N. Y., is building the first section of a plant designed to supply low-pressure exhaust steam for heating, and high-pressure steam for process work. The plant will be located in the business district of the city, and will be ready for operation by October. The equipment will include two pow-dered-coal fired boilers with a capacity of evaporating about 120,000 lbs. of water per hour at 375 lbs. pressure. The heating steam main will be carried in the same duct with the 100-lb process steam main.

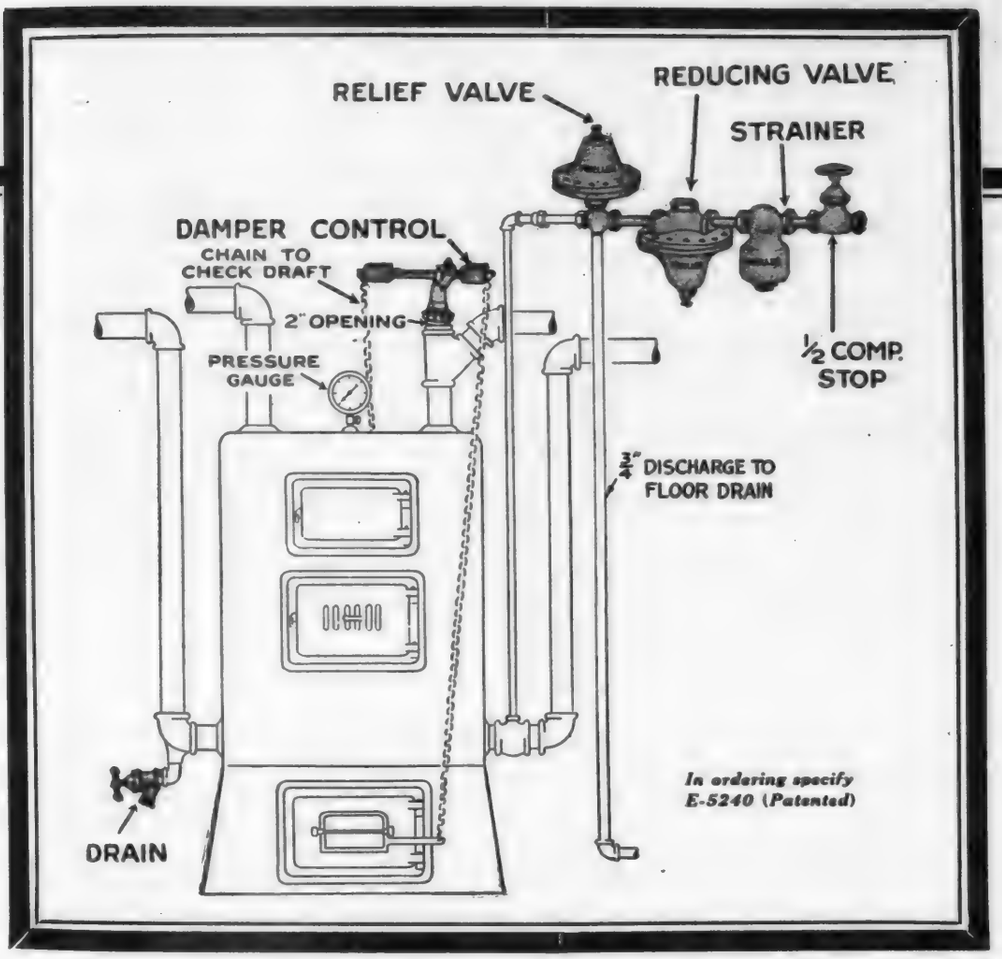
Saginaw, Mich.—Plans for the expansion of the central heating plant of the Consumers Power Company, including doubling its boiler capacity and constructing new high-pressure mains in the east side business district, have been announced by John K. Swanson, general manager of the local plant. The cost of the improvements is estimated at $150,300 and an appropriation for that amount has already been made by the company. The new construction will include the installation at the heating plant of a 494 H.P. boiler to cost $68,000 and the construction of two large high-pressure mains, at an estimated cost of $75,300. Another $7,000 will be expended in laying new steam service mains. The larger of the two new high-pressure mains will be a 10-in. line with a 3-in. return. The other main will be 8 in.

Kewanee, Ill.—An installation of a central heating plant is being considered by the Kewanee Chamber of Commerce to heat the business section of the city. The proposal is to heat four blocks of the down-town district and the propositions considered include a central heating plant and the development of a block system with a unit in each block. It is proposed to co-operate the system on live steam. At a recent meeting of the Chamber of Commerce those present voted in favor of a central heating plant.

Warren, Minn.—Utilization of the exhaust steam from the power house as a means of heating the central business district of Warren is being considered by a special committee representing the Warren Commercial Club. Tentative proposals have been presented by Bain and Robb, heating engineers and contractors, of Milwaukee and Minneapolis.

Lincoln, Neb.—The State Senate as advanced to third reading the house bill providing for a levy of 22/100 of a mill until 1928, inclusive, for the completion of the Capitol, purchase of a site and heating plant, etc. The bill places a limit of $9,000,000 upon expenditures for all purposes.

Long Beach, Cal.—The new Middough building, which is electrically heated throughout, has set a standard for large office buildings in Long Beach as it is the only building in the city electrically heated. The electric heat equipment was furnished by the Ward Akeley Electric Company. An electric radiator is placed in every room in the building.



Easy to *sell*—easy to *install*

The MUELLER Automatic System of Hot Water Heat Control

This system of hot water heat control operates directly on city water pressure and eliminates the unsightly and expensive expansion tank.

The operation of the system is entirely **automatic.** The owner pays no attention to the valves—a fact that has received the praise of thousands of users.

The simplicity and established dependability of the system, coupled with its relatively low cost, make it an easy system to sell. The parts are shipped assembled and can be installed in an hour.

Ask for complete information

MUELLER COMPANY ***(Established 1857)***

Factories: Decatur, Ill.; Port Huron, Mich.

Canadian Factory
MUELLER, Ltd., Sarnia

Branches
New York, San Francisco, Los Angeles

MUELLER

QUALITY BRASS GOODS

New Corporations

Electro-Chemical Pattern & Mfg. Co., 740 Meldrum Avenue, Detroit, Mich., manufacturers of electro-chemical patterns and core boxes, has been organized with a capital stock of $40,000 first preferred stock, and 10,000 shares of no par stock, succeeding the State Pattern & Mfg. Company. For the past three years the latter company has been making metal patterns and core boxes of copper by electro deposition, a process similar to the electrotyping process. The new corporation plans to extend the business to all parts of the country. The company has issued an interesting price chart for determining the cost of any metal pattern.

Dickson Martin Co., Inc., Chicago, Ill., capital $20,000, to conduct a heating business.

O'Brien-Munsell Heating Co., Kenosha, Wis., capital $10,000. Incorporators: W. O'Brien, O. Munsell and K. O'Brien.

Flett-Gould Co., Wakefield, Mass., incorporated to deal in heating apparatus. Incorporators: Lyman R. Gould, William Flett and J. Watson Flett.

Steam Appliance Co., Tacoma, Wash., capital $25,000, to manufacture heating devices.

N. B. Brown & Co., Chicago, Ill., capital $50,000, to manufacture heating, plumbing and refrigerating apparatus. Incorporators: N. B. Brown, R. B. Barnes and H. F. Brown.

Heat King Oil Burner Co., Kansas City, Mo., capital $50,000, to manufacture oil burners. Incorporators: D. E. Anderson, O. W. Anderson and Frank E. Stiles.

Walter & Parrish, Inc., Peoria, Ill., capital $50,000, to manufacture ventilators and heating systems. Incorporators: John H. Parrish, Emily C. Walter and Mary Bartley.

New Firms and Business Changes

Hexo Mfg. Co., Inc., has been organized by H. A. Hanson, formerly associated with Haines, Jones & Cadbury Company, Philadelphia, and more recently with Pierce, Butler & Pierce Manufacturing Corporation, New York, to manufacture the HXO water heat. Mr. Hanson is the president of the company and inventor of the HXO heater. The company has taken quarters at 5620 Grand Central Terminal, New York.

Illinois Valve & Mfg. Co., Chicago, Ill., has increased its capital stock from $15,000 to $30,000.

George E. Gibson Co., mechanical contractors, New York, has removed its offices from 103 Park Avenue to the Building Loan Association Building at 44th Street and Lexington Avenue.

Chattanooga Heating Co., Chattanooga, Tenn., has added plumbing, contracting and job work to its activities. The new department is handled by Al West. The firm has changed its name to the Chattanooga Heating and Plumbing Company.

SIROCCO FANS AND BLOWERS are covered in all sizes and types in Bulletin 1801, just off the press, received from the American Blower Co., Detroit, Mich. Sirocco standard arrangements are shown, and in tabular form are presented data on all the sizes, showing volume of air handled, outlet velocity, tip speed, R. P. M., and B. H. P. Included in the bulletin are also pages descriptive of American direct-fired unit heaters and "ABC" air washing and cooling fans. Size 8½ x 11 in., 72 pages.

ILG VENTILATION is a large folder issued by Ilg Electric Ventilating Co., Chicago, illustrating, through the medium of nearly fifty half tones, Ilg ventilating fans in banks, stores, restaurants, bakeries, hotel kitchens, garages and many other locations where positive and, at times, rapid changes of air are necessary. The illustrations show installations varying in size from the baby 12-in., in a residence kitchen, to a 90-in. in a well-known pure food establishment.

New York.—Commercial arbitration received further impetus at a meeting of an Organization Committee for the Arbitration Conference Board, held at the home of Vincent Astor, New York, March 19. A sub-committee has been appointed to consider a digest of the work of existing organizations engaged in arbitration and to formulate a plan for submission to the Organization Committee.

Chicago Heating and Piping Contractors Association held a dinner at the Hotel Sherman, March 26, which was attended by some 75 members and guests. H. B. McGinnis acted as toastmaster.

National Industrial Conference Board reports that a stable, sound and even flow of business activity for the remainder of the year is forecast in opinions given by industrial leaders. Business during the balance of the year, however, it is indicated, will probably be conducted under conditions of rising interest for loans, with a tendency toward lower prices in some industries, and generally stationary wages.

New York Edison Co., New York, held an exhibition of electrical heating appliances, both industrial and domestic in its showroom at Irving Place and 15th Street, N. Y., March 30-April 4.

What is College Training Worth to the Young Man Entering Industrial Life is a question answered in a series of studies of the relation of college education to the industries now being made by the research staff of the National Industrial Conference Board. Opinions of executives as to the value of college men in business vary widely.

In the metal trades industry almost one-half of the positions "at the top" are held by college graduates.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

FACTORY REPRESENTATION WANTED—Sales engineer, office in Baltimore, wishes to represent manufacturers of heating and other mechanical appliances. Protected territory. Commission basis. Address Box 55, care Heating and Ventilating Magazine.

POSITION WANTED—Executive engineer desires position as manager, department manager or executive of firm in the heating and ventilating field. Location East, Philadelphia or vicinity preferred. Address Box 51, care Heating and Ventilating Magazine.

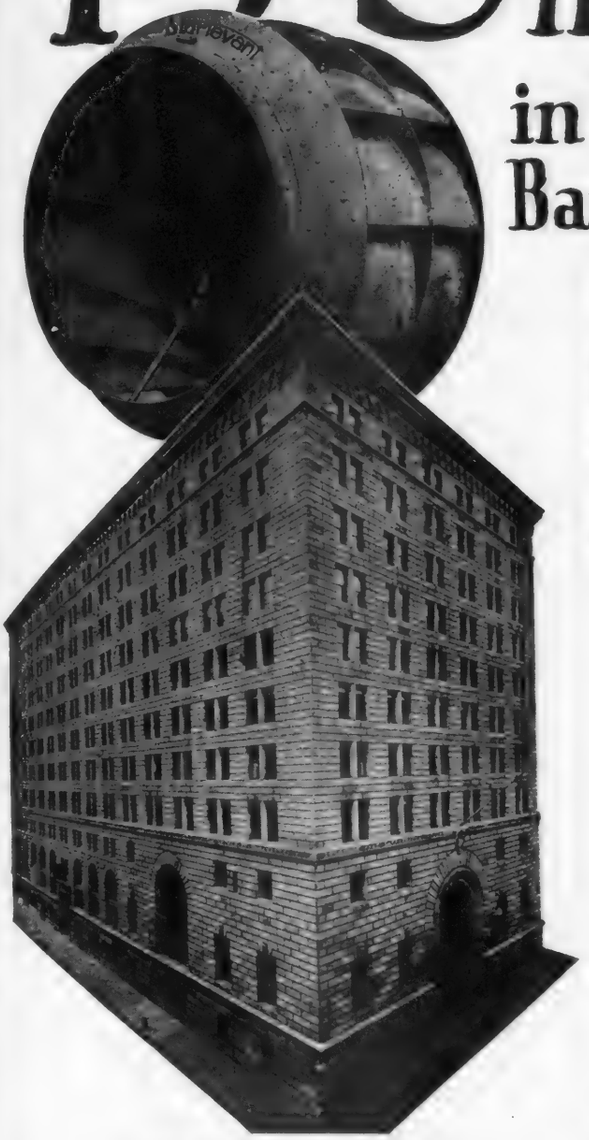
MANUFACTURING FACILITIES WANTED—Engineer executive with a national reputation in the heating and ventilating field, desires to establish connection with manufacturing concern, with a view of manufacturing and marketing an important new device for which a universal demand exists. Address Box 52, care Heating and Ventilating Magazine.

MANUFACTURER'S REPRESENTATIVE—Canadian distributors with warehouse facilities and Dominion wide connection in heating field seek additional lines. Address Box 124, care Heating and Ventilating Magazine.

SALESMAN WANTED—Salesman wanted for New York and vicinity to handle the well-known line of apparatus for the heating and cooling of liquids. Man must have confidence in his ability to earn his way on a commission basis. Office buildings, hotels, apartment houses and industrial plants are buyers of this type of equipment. Experience essential in the sale of heating and cooling equipment to this trade essential. Address Box 53, care Heating and Ventilating Magazine.

PATENT AND PROTECT
Your valuable inventions
and
Register your trade marks.
Prompt attention. Superior Service
Lester L. Sargent, Patent and Trade Mark Atty.
524 10th Street, Washington, D. C.

15 Sturtevant Silentvanes in The First National Bank Building of Boston



York & Sawyer, Architects
Meyer, Strong & Jones, Inc., Engineers
Stone & Webster, Inc., Contractors

This fine structure gets the best in the "air line." Adequate ventilation is supplied by fifteen Sturtevant Silentvane fans which distribute twelve million cubic feet of air per hour throughout this building.

Sturtevant Air Washers are also installed here to thoroughly cleanse the air before it is distributed by the Silentvanes.

The Silentvane develops a maximum efficiency of 83%—the highest efficiency ever secured from a centrifugal fan. It runs more quietly at higher speeds than any other type of heating and ventilating fan on the market to-day.

The Silentvane saves on power and motor costs. The self-limiting horse power characteristic prevents motor overload, therefore it is unnecessary to provide a motor rating excessively greater than the fan load requires in operation.

Send for our Silentvane Fan Bulletin No. 290. It is just the right size for your files.

Specify "Sturtevant Silentvanes" and Save Power.

B. F. STURTEVANT COMPANY

Sales Engineering Offices

Atlanta, Ga.
Boston, Mass.
Buffalo, N. Y.
Camden, N. J.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Tex.
Detroit, Mich.
Denver, Colo.
Hartford, Conn.
Indianapolis, Ind.
Kansas City, Mo.
Los Angeles, Cal.
Minneapolis, Minn.
Montreal, P. Q.
New York City
Pittsburgh, Pa.
Portland, Ore.
Rochester, N. Y.
St. Louis, Mo.
Salt Lake City, Utah
San Francisco, Cal.
Seattle, Wash.
Toronto, Ont.
Washington, D. C.

Plants Located at

Hyde Park, Mass.
Sturtevant, Wis.
Berkeley, Cal.
Framingham, Mass.
Camden, N. J.
Galt, Ontario

Foreign Representatives

American Trading Co. — Tokio
American Trading Co. — Shanghai
Catton Neill Eng. & Mach. Co., — Manila
H. P. Gregory Co., Ltd — Sydney
Honolulu Iron Works Co., — Honolulu, T. H.
Blair, Reed & Co., Ltd. — Wellington
Wesselhoeft & Poor — Caracas
Wesselhoeft & Poor — Bogota
General Machinery Co. — Tampico
Pedro Maritino, Inc. — Lima
Compania Italio-Americana de Importacion — Buenos Aires
A. E. Barker — Johannesburg

Sturtevant
PUTS AIR TO WORK

128x

Start Thinking About Next Winter—NOW

You will find it a mighty wise thing to do. For when the leaves begin to fall next October, heating problems will begin to worry you tremendously.

Regardless of the task assigned to them, Pecco Heaters in small garages and shops to large modern factories, are meeting requirements. Thousand of installations in all climates and under all shop conditions are daily proving the worth and thoroughness of Pecco Heaters.

In plants where steam is available Pecco Steam Units utilize either live or exhaust steam. Without the installation of an intricate or ramified system of ducts for heat distribution they spread heat evenly throughout great spaces. And because they do not depend on the comparatively passive principle of radiation they make more economical use of the heat that steam generates.

In plants where steam is not available Pecco Direct Fired Units perform admirably, heating large areas. They burn coal, coke or wood, or may be fired with oil burners or gas.

Where a product is to be dried, or ventilation is a problem, or gas fumes are to be expelled, as in garages or foundries, Pecco Units serve a double purpose.

Tell us your problems and let us send you literature covering the complete line and a large list of satisfied users of Pecco Heaters. Of if you prefer we will have our representative call and show you the benefits of a Pecco Installation. No obligation on your part.

Ask these Pecco Users—they know

Roxana Petroleum Company, Kemper Military Academy, Hamilton-Brown Shoe Company, Mississippi Glass Company, National Carbon Company—and there are hundreds of others.

The makers of Pecco Heaters also make Pecco Blow Pipe and Ventilating Systems. Ask us how they can serve in your plant.

PECCO INCORPORATED

2957 North Market St. ST. LOUIS

PECCO INC. PECCO ST. LOUIS

KNOWLES

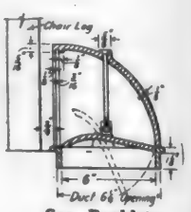
AISLE HOOD AIR DEFLECTOR

FOR AUDITORIUMS

Placed under the aisle seats only to throw air out into the aisles in one direction. Positively no draughts.

KNOWLES MUSHROOM VENTILATOR CO.

202 Franklin Street, New York



See Booklet

A New and Profitable Field Now Available

C. S. B. Approved Sprinkler Heads may now be bought from us direct, either separately or with all other necessary sprinkler equipment. This opens a new and profitable field for you that has not been available heretofore. There are many prospects for sprinkler systems in your vicinity. Get in on this business at a good profit.

Also, after a fire, sprinkler heads have to be replaced. A stock should be kept on hand for demands of this nature.

Write us for prices and details. We cooperate with you in every way.

C. S. B. SPRINKLER CO.

54 Batterymarch St., Boston, Mass.

Factory: Laconia, New Hampshire

Canadian Representatives: L. E. Moulin Co., Inc., 142 Inspector St., Montreal, Canada.

Clean Air for Department Stores

Located in the dustiest sections of cities and towns, department stores surely need clean air. Their fixtures, decorations and merchandise are particularly susceptible to dust damage, and the effect of dust and its bacteria on sanitary and comfortable living and working conditions cannot be overlooked.

The operating principle of

MIDWEST AIR FILTERS

adapts itself particularly to department store ventilation, in that harmful moisture is not introduced in the cleaning process, and all harmful dust and bacteria are removed.

Engineers and architects in every section of the country realize the superiority of Midwest Air Filters in department store ventilation, as evidenced by our orders of the last twelve months. The list includes nationally known stores in New York, Philadelphia, Chicago, Detroit, etc. (Macy's, of New York, for instance, where practically all the air cleaning equipment is Midwest.) Smaller stores in the large cities, and stores in smaller cities and towns are also included, however—such as the Carlisle Store, Ashtabula, Ohio; the Oransky Store, Des Moines, Iowa, and the Zahn Dry Goods Store, Racine, Wis.

Are you working on any such jobs now?

Midwest Air Filters do not clog up. Any one cell of an installation requires cleaning only once every 6 to 8 weeks. With routine cleaning a constant resistance of ½" water gauge is maintained. With this performance is coupled a cleaning efficiency unsurpassed by any other filter on the market.

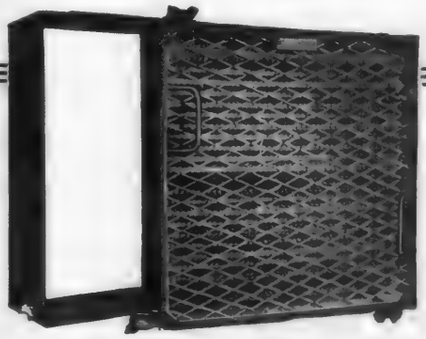
MIDWEST AIR FILTERS

INCORPORATED
100 EAST 45TH STREET
NEW YORK CITY

Branches in Principal Cities

Midwest Canada Ltd.
83 Craig St., West
Montreal, Canada

Midwest Air Filters Pacific, Inc.
Monadnock Building
San Francisco, California



New Model Type U2 Midwest Air Filters Frame and Cell

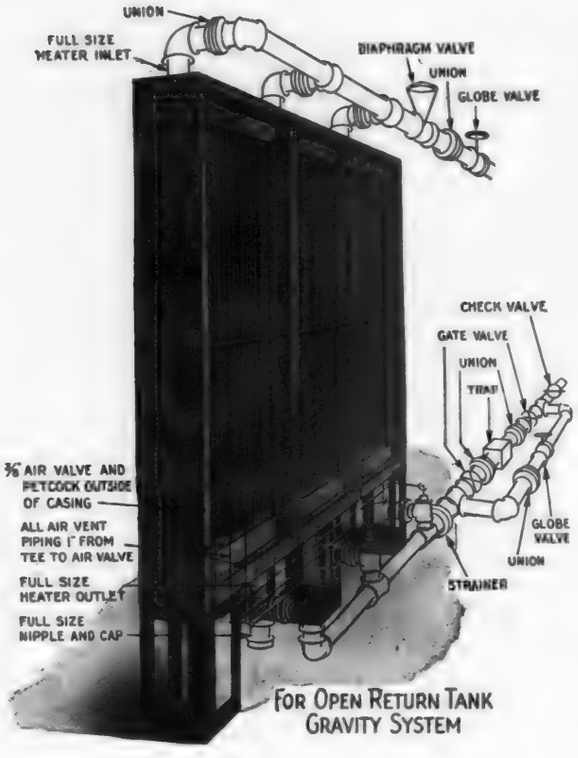
OUTSTANDING FEATURES

An installation is built up of standard interchangeable units, (a frame and filter cell 20" x 20" x 6½" overall, with a capacity of 800 C. F. M. per unit.) A positive air-seal is provided between each cell and frame and between adjoining frames on all sides.

The unique Midwest baffle-impingement principle makes these filters the most efficient air cleaners in existence. The filter medium consists of a series of specially shaped and perforated metal sheets coated with a sticky viscous fluid. Dusty air in passing through the filter cell, is forced to change its direction innumerable times.

Dust particles are impinged against the sticky surfaces of the filter sheets, where they are caught and held.

A series of specially designed sheets of knitted metal mesh are provided at the rear portion of the cell, on which fine dust particles which might pass the first filter sheets are impinged and caught.



AEROFIN CORPORATION
750 Frelinghuysen Avenue
Newark, N.J.
L. C. Soule, *Sec'y and Chief Engineer*

AEROFIN

Fan-System Heating Surface

TO ENGINEERS AND ARCHITECTS:

Aerofin Saves Space and Weight.

The light weight and non-corrosive features of Aerofin, together with its unit construction, space saving and because it comes to the job already encased and ready for steam connections, demonstrates its superiority, and for this reason we believe Aerofin merits being incorporated in your specifications. SINCE THERE IS NO EQUAL TO AEROFIN, WHY NOT SPECIFY IT OUTRIGHT? At least, we ask you to specify Aerofin as a standard and to figure out the exact sizes and number of units required so that the contractor will know what to figure on.

TO THE CONTRACTOR:

SAVE TEN CENTS PER FOOT OF HEATING SURFACE by erecting the (completely encased) Aerofin Units in the same number of HOURS as you would need DAYS to erect the heavy heaters.

SAVE MORE MONEY with Aerofin on account of the smaller number of steam and return connections required.

DON'T FORGET the saving in freight and cartage.

No extra reinforcement of the building construction required with Aerofin—may be suspended from ceiling with small angles and rods, without expensive platforms—may be handled with only ordinary care and assembled without using any block and tackle or scaffolding.

These features demonstrate that you can really save money by installing Aerofin altho the first cost, f. o. b. factory, may be a trifle higher than that of other fan-system heaters.

Illustration shows the ease with which several units high or wide of Aerofin may be assembled together by simply bolting thru the template punched flanges.

Aerofin Is Sold ONLY by Manufacturers of Nationally Advertised Blower Heating Apparatus

HEATS IN WINTER COOLS IN SUMMER

The heating system which remains idle during the summer months does not give your customer the full benefit of his investment.

Wing Featherweight Unit Heaters

present a most efficient means of heating industrial plants, mills, garages, factories, etc. during the winter time and in addition serve as a cooling medium in summer by circulating large volumes of air throughout the building. It is also possible to arrange each installation so as to introduce fresh air from outdoors with these units.

The saving effected by the dual operation of this equipment is sure to hold the interest of your customers. Let us further explain.

L.J. Wing Mfg. Co.

Fans and Blowers *Damper Regulators*
Unit Heaters *Small Turbines*
Hudson and 13th Sts. **NEW YORK**

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA

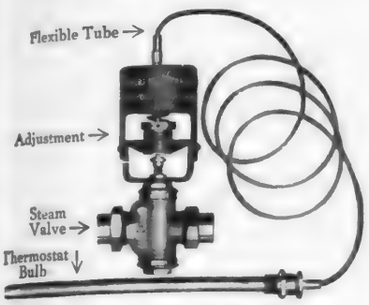
For VENTILATION use LYON Toad Stools

They are Vent Caps of great strength, unobstructed throat, rigid non-rattling construction. The adjustment is from full open to full closed. The height of the floor member prevents sweeping dust and refuse into them. Their efficiency and economy make them particularly adaptable for theatres, auditoriums, etc.

Send for table of capacities and velocities

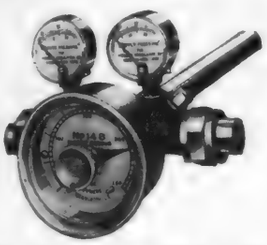
LYONS PRODUCTS COMPANY
710 Union Trust Bldg.
CHICAGO ILLINOIS

3 of the more than 50 Powers regulators



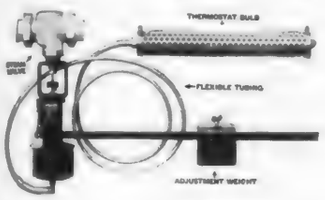
The Powers No. 11 Regulator

This regulator is also self-operating. It is designed for control of liquid temperatures or of any materal in which the thermostatic bulb can be immersed. Used on Steam Heated Tanks, Vats, etc. Simple, accurate and easy to install.



The Powers No. 14-B Regulator

This regulator is operated by air pressure. It is extremely sensitive, and controls temperature within a fraction of a degree. Used on retorts, baking ovens, tanks, etc.



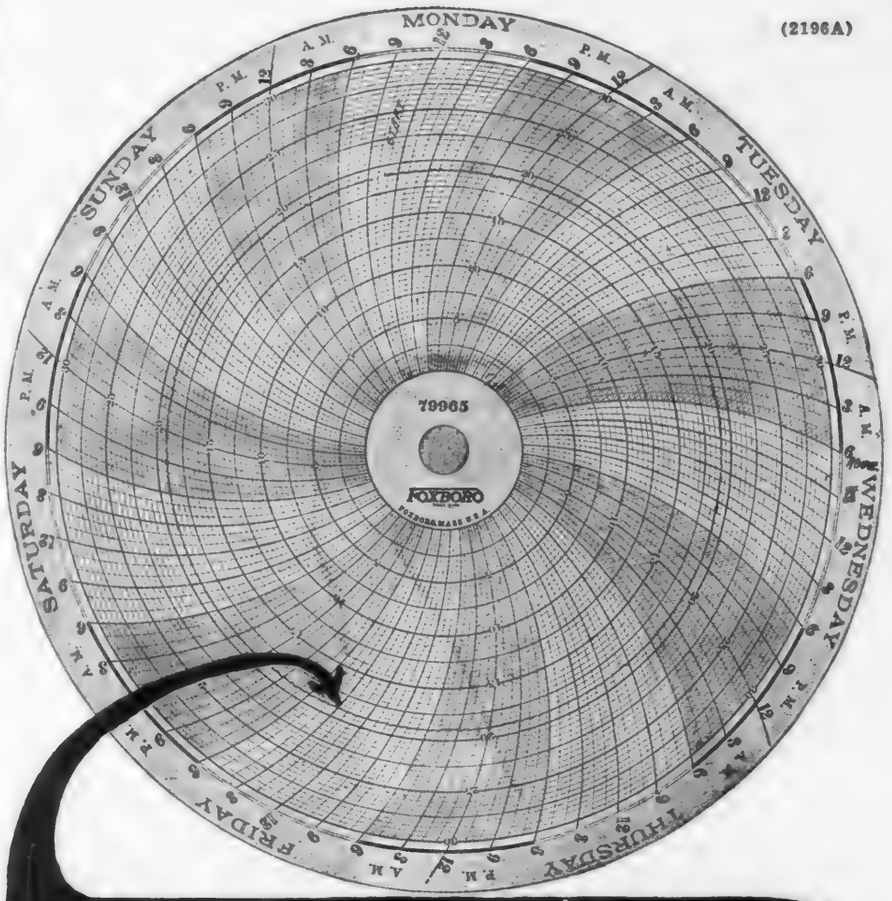
The Powers No. 15 Regulator

A self-contained regulator, designed for the control of air temperatures in drying rooms, kilns, etc. Requires no air or water power for its operation. May be adjusted for different temperatures, at will.

Ask about our "Special Test" Offer

Name the place or process where you think automatic temperature control might benefit and we will respond with a definite recommendation, price, and full particulars of our "Special Test" offer, whereby you may see the results you want, actually produced in your client's plant. If he is not satisfied, he won't even be asked to buy.

(2196A)



Do you get Results like this?

Look closely! The temperature-record line is so nearly a perfect circle it looks almost like one of the circles printed on the chart. It tells a story of *even temperature* maintained by a POWERS automatic regulator on a secret process in America's largest fibre silk mill, at Buffalo.

In this installation the regulator controls both heating and cooling mediums, maintaining a remarkably accurate room temperature.

During the week this record was made, the outdoor temperature fluctuated continuously — from 72° to 40° F. Week after week, similarly perfect control is recorded—not only here, but whenever POWERS regulator is on the job.

If your clients are not getting results like this you owe it to yourself to find out what we can do for them. In our 34 years of specialization in temperature control, we have mastered many difficult problems, and through this experience have developed over 50 different regulators, and have one to fit *any* condition—or will make a new one.

THE POWERS REGULATOR COMPANY

34 years of specialization in temperature control

2718 Greenview Ave., Chicago

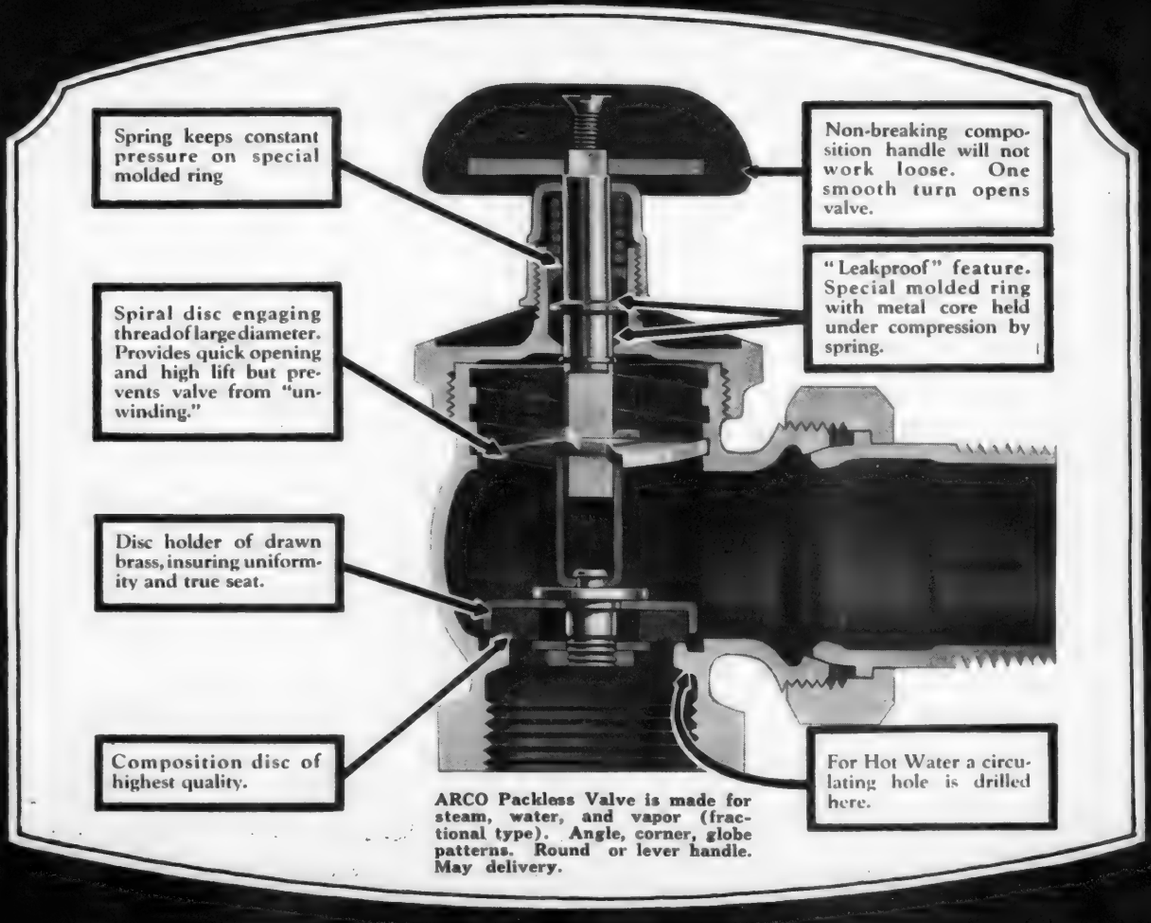
Atlanta, Baltimore, Boston, Buffalo, Butte, Mont., Charlotte, N. C., Cincinnati, Cleveland, Denver, Des Moines, Detroit, El Paso, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, Nashville, New Orleans, New York, Philadelphia, Pittsburgh, Rochester, St. Louis, San Francisco, Seattle

CANADIAN OFFICES

Toronto, Montreal, Halifax, Winnipeg, Calgary, Vancouver

ARCO
PACKLESS VALVE

moderate in price


Spring keeps constant pressure on special molded ring
Spiral disc engaging thread of large diameter. Provides quick opening and high lift but prevents valve from "unwinding."
Disc holder of drawn brass, insuring uniformity and true seat.
Composition disc of highest quality.
Non-breaking composition handle will not work loose. One smooth turn opens valve.
"Leakproof" feature. Special molded ring with metal core held under compression by spring.
For Hot Water a circulating hole is drilled here.

ARCO Packless Valve is made for steam, water, and vapor (fractional type). Angle, corner, globe patterns. Round or lever handle. May delivery.

Ventilating the Nation's Educational Buildings

Representative American Blower Equipped Schools and Their Heating Contractors

Adams High
Cleveland, O.
Spohn Htg. & Vtg. Co.

Altoona Junior High
Altoona, Pa.
Sanitary Engineering Co.

Atherton High for Girls
Louisville, Ky.
F. R. Whitton & Son

Billings High
Billings, Mont.
Northern Plumbing & Heating Co.

Boston Public Latin School
Boston, Mass.
Mass. Sprinkler, Power & Sanitary Eng. Co.

Browne
Malden, Mass.
P. A. Dolan Co.

Cass High—New Addition
Detroit, Mich.
Harrigan & Reid

Catholic Boys' High
Evansville, Ind.
H. G. Newman Plumbing Co.

Central High School
Tulsa, Okla.
Watt Plumbing, Heating & Supply Co.

Cornell University
Baker Chemical Laboratory
Ithaca, N. Y.
Wm. H. Taylor Co.

Danville High
Danville, Ill.
E. J. Ryan Co.

Duffield School
Detroit, Mich.
Stephen J. Fraser

East High School
Columbus, Ohio
The S. A. Esswein Plumbing & Heating Co.

Elementary Schools 1-9-21-60
Buffalo, N. Y.
Power Efficiency Corp.

Elementary and Junior High
Rutherford, N. J.
Hugh D. O'Rourke & Co.

El Dorado High
El Dorado, Ark.
El Dorado Plb. & Htg. Co.

Elizabeth School No. 19
Elizabeth, N. J.
Walter P. Dunn, Inc.

Elliott School
Lincoln, Neb.
Newberg & Brookstrom

Emporia High
Emporia, Kans.
Salina Plumbing Co.

Erie High
Erie, Pa.
Gannon & Carey Co.

Evanston High School
Evanston, Ill.
Narowetz Htg. & Vtg. Co.

Eveleth School
Eveleth, Minn.
Stack Bros.

Fanning Trade School for Girls
Worcester, Mass.
Power Htg. & Ventg. Co.

Flint High
Flint, Mich.
The Newitts Co.

Ford School
Highland Park
Glanz & Kallan Co.

Fort Dodge High
Fort Dodge, Iowa
Thos. Rinehart

Franklin School
Cedar Rapids, Iowa
Carstens Bros. Ackley

Franklin School
Cleveland, Ohio
Amer. Piping & Equip. Co.

French Junior High
Lansing, Mich.
Edw. Gibbons

Girls' Commercial High School
Brooklyn, N. Y.
Almirall & Co., Inc.

Grinnell High
Grinnell, Iowa
Wm. Boyce

Harrison Park School
Grand Rapids, Mich.
Phoenix Sprinkler & Htg. Co.

High School of Commerce
San Francisco, Calif.
W. H. Pickard

Hutchins School
Detroit, Mich.
Drake Avery Co.

Independence High
Independence, Kansas
Sell-Orr Heating Co.

Jefferson School
Detroit, Mich.
Irvine & Meier

Jefferson School
Cleveland, Ohio
Chappell-Warren Co.

Jerome School
Jerome, Idaho
Inland Engineering Co.

Junior High School
Medford, Mass.
Reardon Bros. Co.

Longfellow School
Toledo, Ohio
H. C. Baker Co.

Lyndon Institute
Lyndonville, Vt.
Goss Supply Co.

North Side High School
Memphis, Tenn.
State Heating & Power Co.

North High School
Omaha, Neb.
J. J. Hanighen Co.

Northside High School
Boulder, Colo.
The City Plb. & Htg. Co.

Northwestern High School
Detroit, Mich.
J. W. Partlan

Oliver School
South Bend, Ind.
W. W. Sibley

Ottawa Hills High
Grand Rapids, Mich.
Glendon A. Richards Co.

Paulist School
New York City
Wm. H. McKiever, Inc.

Peabody High School
Peabody, Mass.
Stone-Underhill Htg. & Vtg. Co.

Phillips High
Birmingham, Ala.
The Pate Co.

Poe School
Detroit, Mich.
O'Connor Bros.

Runkle School
Brookline, Mass.
General Cons. & Repair Co.

Sacred Heart Academy
Detroit, Mich.
Harrigan & Reid

Schools No. 1-9-33
Rochester, N. Y.
Barr & Creelman Co.

Schools No. 35
Rochester, N. Y.
Arthur S. Reddington

Seiberling School
Akron, Ohio
H. P. Cahill Plg. Co.

Shiloh School
Kansas City, Mo.
MacMahon Co.

Smith Cotton High School
Sedalia, Mo.
Geo. Suter

South Denver High School
Denver, Colo.
Jos. F. Pfeiffer

South Side High School
Fort Wayne, Ind.
Sanitary Eng. Co.

Sparrows Point High School
Sparrows Pt., Md.
Enterprise Steam & Hot Water Heating Co.

St. Elizabeth Parish School
Detroit, Mich.
The Brown Co.

St. Joseph's Parish School
Webster, Mass.
M. J. Daly & Sons

Stowe School
Cincinnati, Ohio
Reliance Heating Co.

Tacoma School No. 117
Washington, D. C.
S. M. Kemp

Union High School
Santa Barbara, Calif.
F. J. Donnelly

University of California
Haviland Hall
Berkeley, Calif.
Carl Doell

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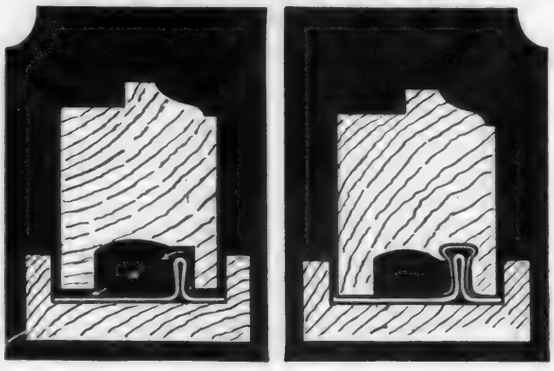

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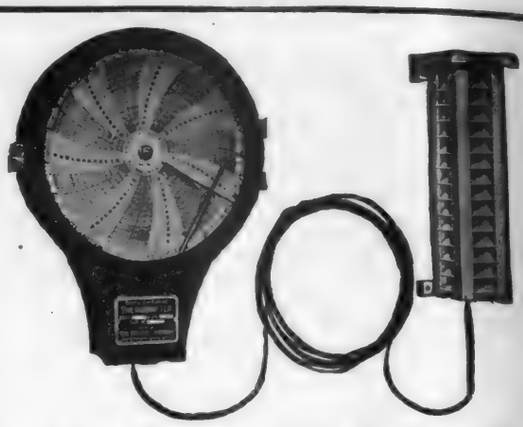

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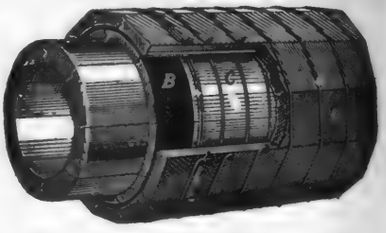

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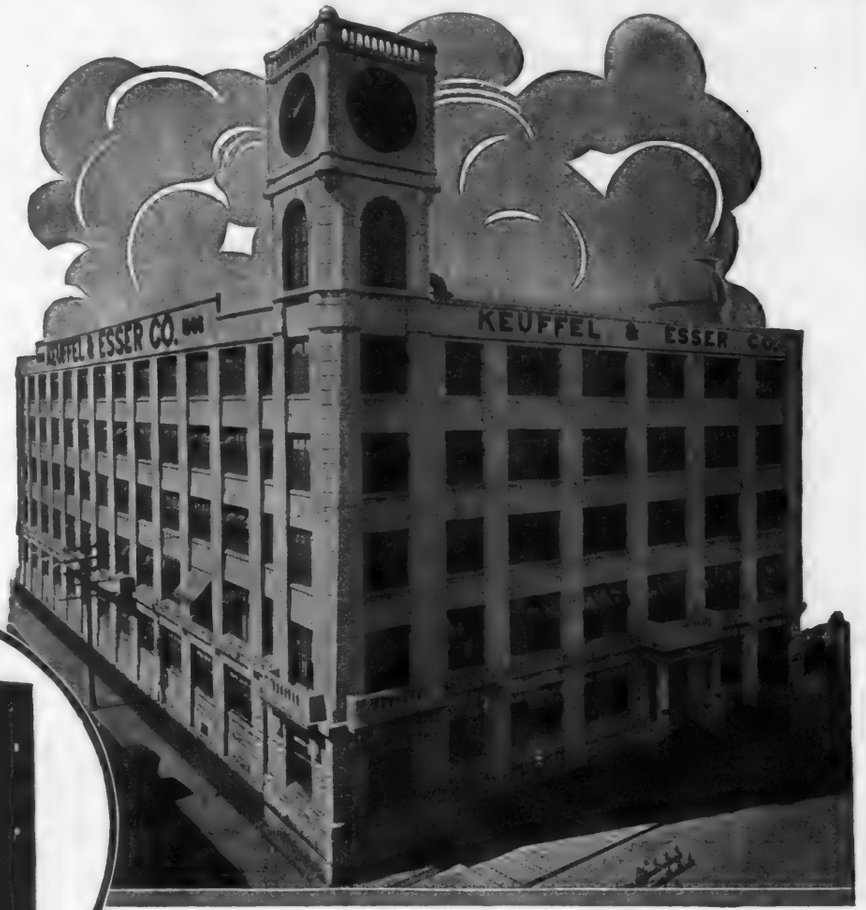

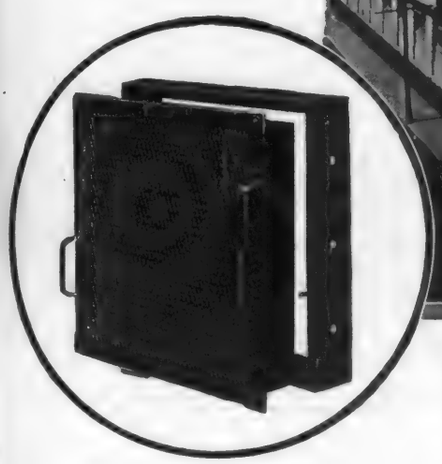

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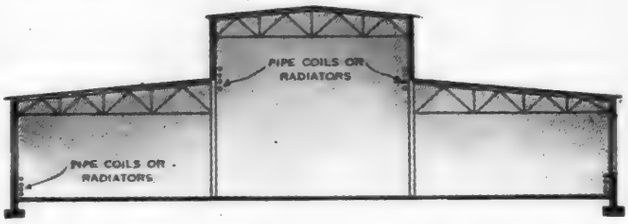
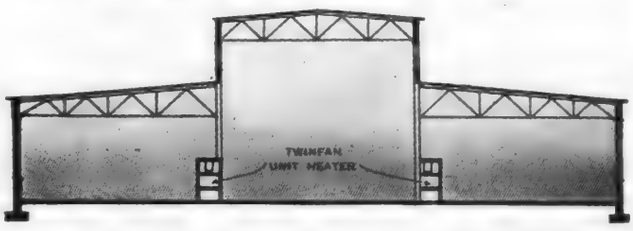


The above diagram illustrates the distribution of heat in a typical industrial building with direct radiation and no means of mechanically circulating the air. It is difficult in such an installation to heat the lower part of the building and a tremendous loss of heat through roof and skylights results from the excessive temperature in the upper portions.

Or the Floor?



With a Twinfan unit heater installation, the cold air is drawn in from a point near the floor, passes over the heating coils, and is discharged horizontally about six feet from the floor. The circulation takes place almost entirely in the lower portion of the building. The temperature can be accurately controlled and the waste of heat is cut to the absolute minimum.

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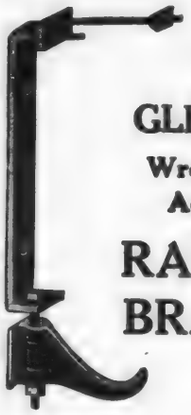

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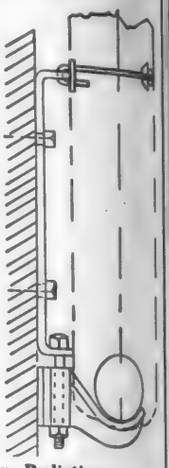

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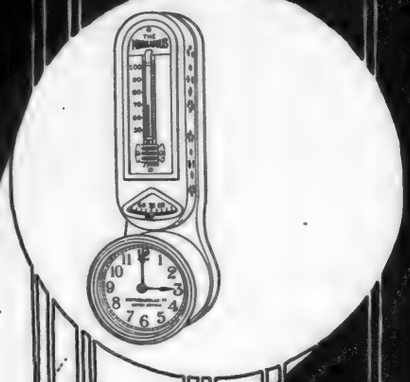

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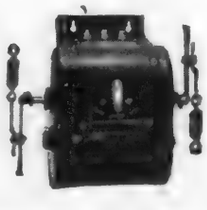

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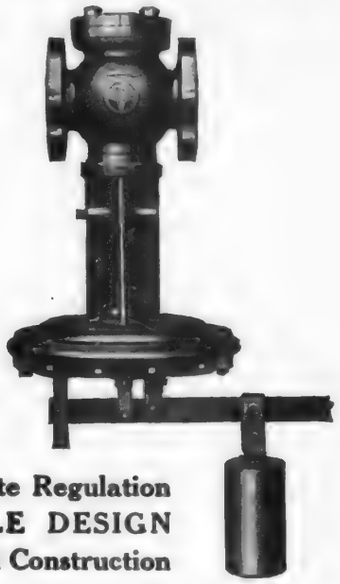

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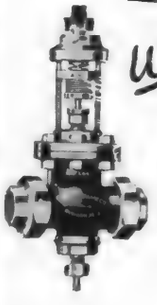

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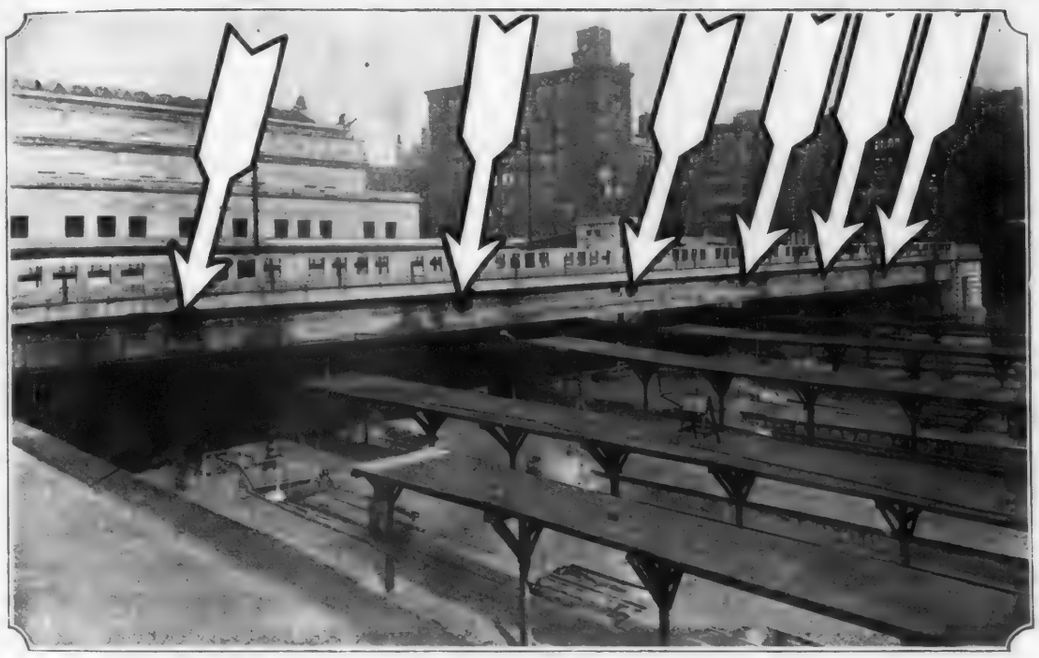

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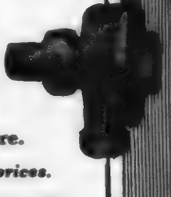

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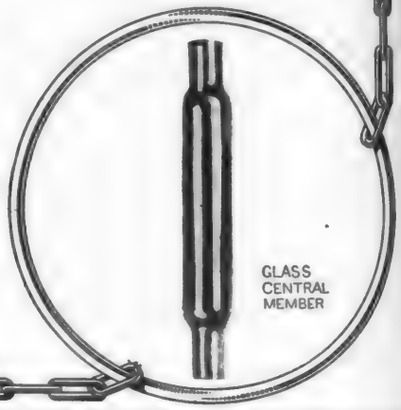

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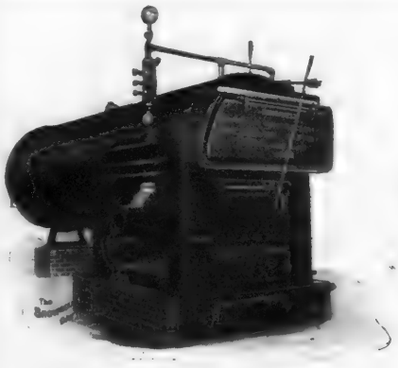

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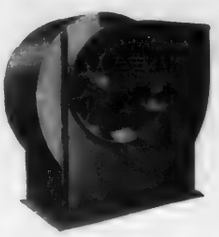

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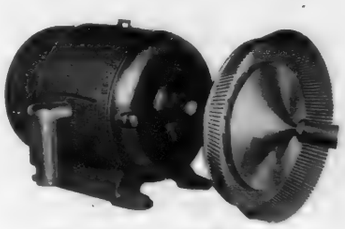

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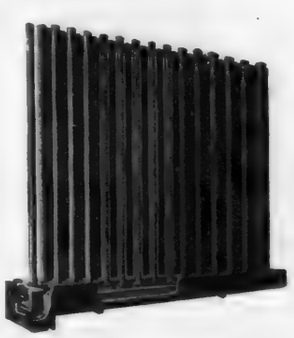

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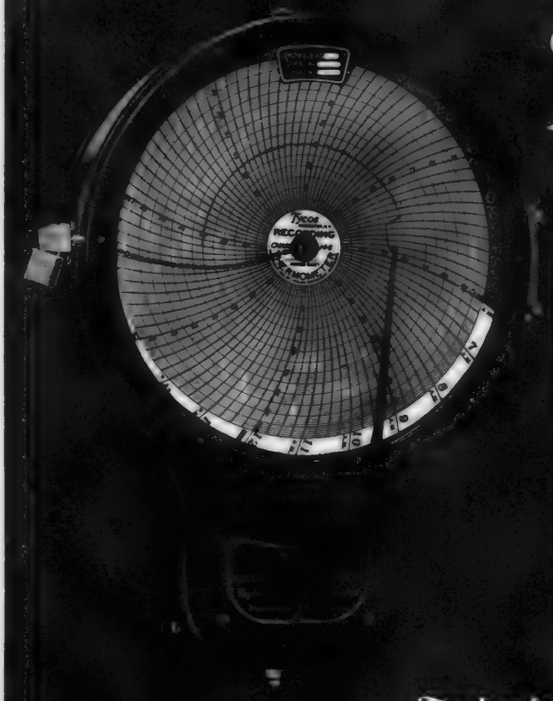

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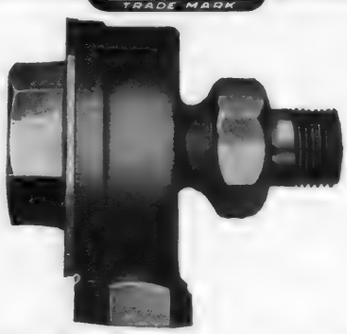

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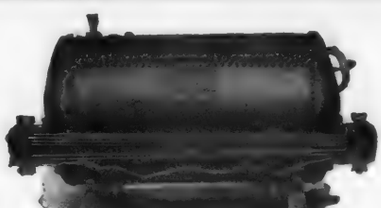

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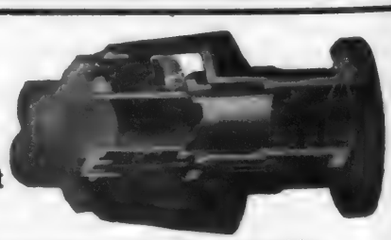

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Standard Gate Valves

Fig. 61

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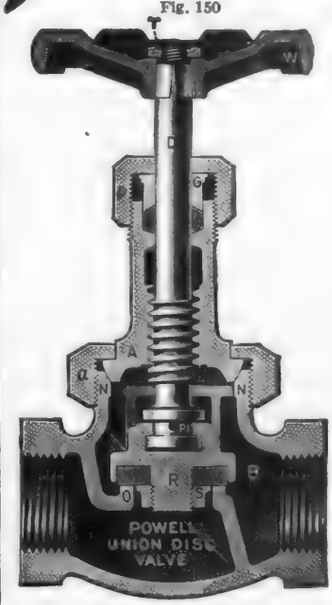
POWELL VALVES

Fig. 150



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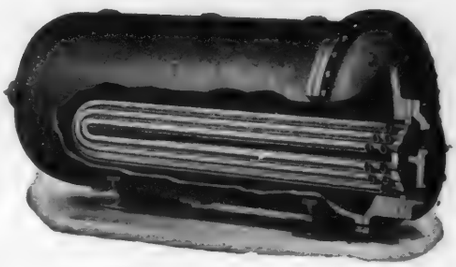

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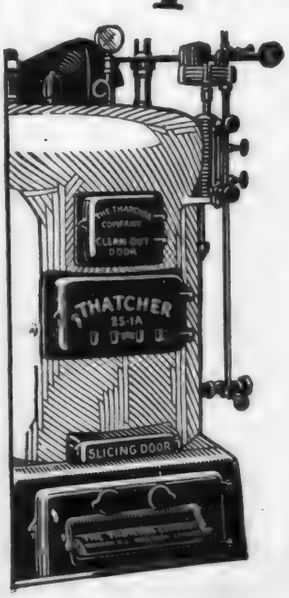

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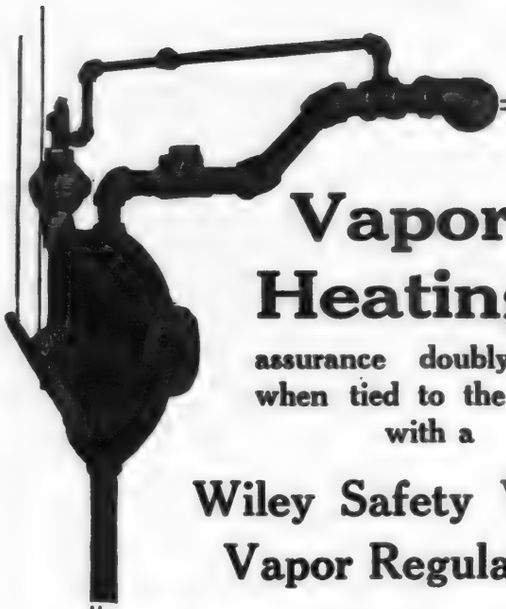

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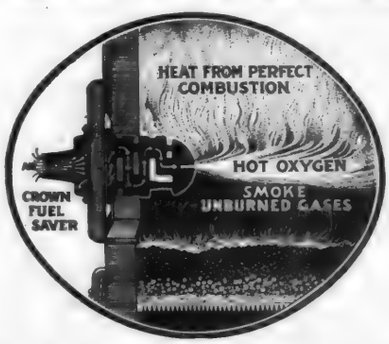

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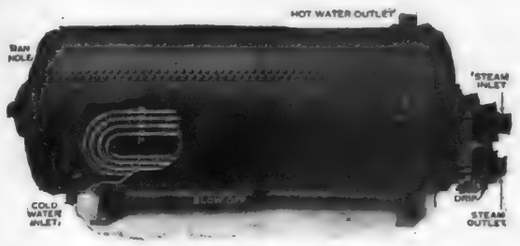

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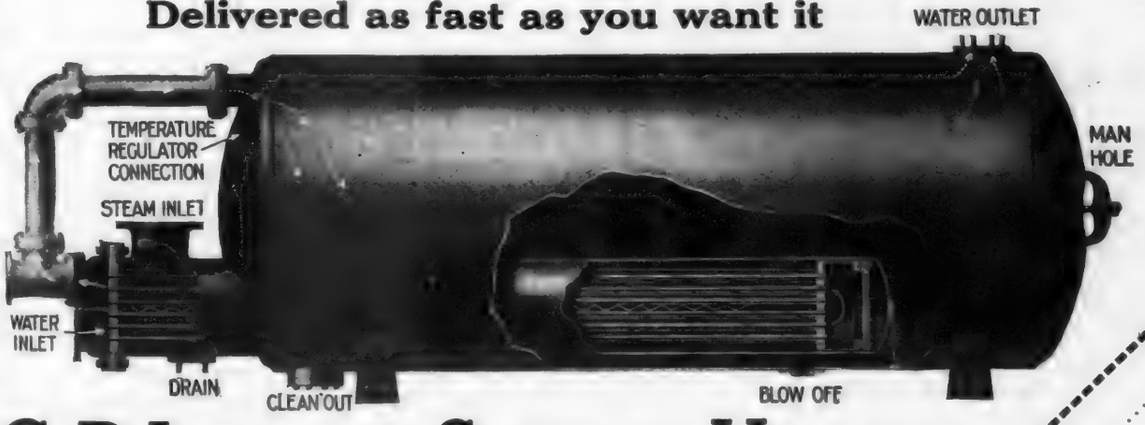

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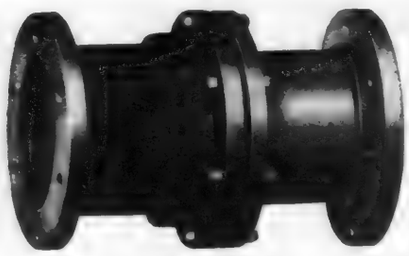

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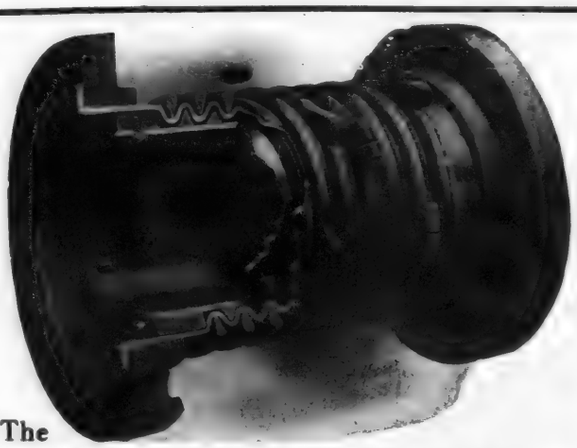

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Multiple corrugations give flexibility. Internal and external equalizing rings distribute the movement equally to each corrugation.

The internal protecting sleeve prevents erosion of the copper joint and reduces friction loss through the joint. The copper diaphragm keeps the Wainwright Expansion Joint tight at all times. There are no glands or sliding parts to repack.

WHEELER CONDENSER & ENGINEERING CO.
149 Broadway, New York
Works - CARTERET, N.J., NEWBURGH, N.Y.

Also manufacture Wainwright Low Pressure Expansion Joints, Wainwright Guides and Anchors, Crescent Brand Copper and Brass pipe, Wainwright Hot Water Heaters and all types of Condensing Equipment.

21

HEATING POWER

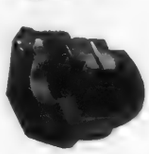
Stanwood Smokeless Boilers

HEATING CAPACITY
Steam—3300 Sq. Ft. to 25,000 Sq. Ft.
Water—5200 Sq. Ft. to 40,000 Sq. Ft.

NO MUD LEGS OR STAYBOLTS
LOW STACK TEMPERATURES
LOW WATER LEVEL—RAPID CIRCULATION

The Stanwood Corporation
CINCINNATI, OHIO
Successor to
THE HOUSTON STANWOOD & GAMBLE CO.

Wonderful Savings in the Cost of Heating are made with Metering Radiator Bushings



Patent Allowed

Let us tell you about the savings the users of this simple device are obtaining.

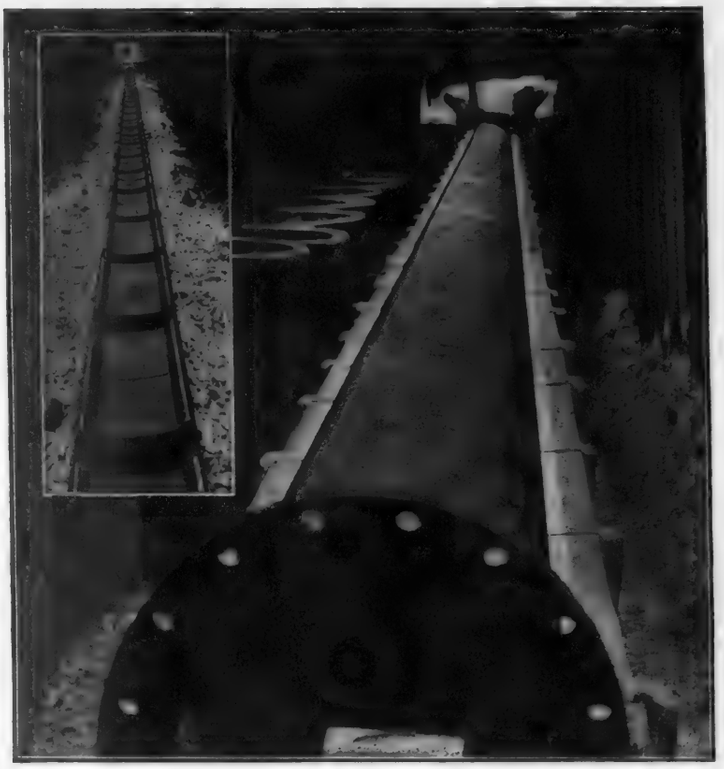
Used to decided advantage on any return line or vacuum installation. Equally good for correcting installed plants as for plants being installed. A wonderful device for reconstructing extravagant plants at a price that will get the job.

Write for circulars

They are placed in supply end and proportion the steam to each radiator as required.

THE HOLLEY ENGINEERING COMPANY
VIRGINIA, MINN.

A list of Ric-wiL users in your territory will gladly be furnished on request.



Ric-wiL installation at the plant of The White Motor Co., Cleveland. Insert shows Base Drain installed.

Triple Economy by Good Engineering

TRIPLE economy results when you specify Ric-wiL Underground Conduit.

—Economy of installation. Ric-wiL complete in the ground costs less than ordinary systems of insulating and protecting underground pipes.

—Economy in the highly efficient job of insulating it does. Steam lines in Ric-wiL are thoroughly profitable.

—Economy in the permanent maintenance of this efficiency. Ric-wiL, in both materials and design, is made to last. It won't deteriorate.

This triple economy is simply the result of good engineering.

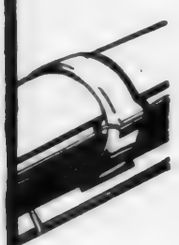
We can demonstrate its profit on any of your jobs. Write for full information.

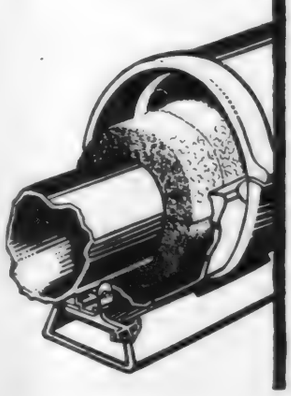
THE RIC-WIL COMPANY, CLEVELAND, OHIO

RIC-WIL Economies No. 3

Ric-wiL Base Drain makes possible extraordinary installation speed—with real labor and material savings.

Dig and grade the trench — no sub-trench needed—and then lay the flat-bottomed Ric-wiL Drain in place like a row of dominoes. No fussing, leveling, or packing with broken stone as required by round drain, to slow up the work. The result is surprising speed—and so much of the job done on schedule or ahead of it.





RIC-WIL

UNDERGROUND CONDUIT

"Keeping Others In Hot Water"—

for
Hotels, apartment buildings, hospitals, Y. M. C. A. buildings, schools and laundries

Special Attention Given to Installations Requiring Large Quantities of Hot Water, with Live or Exhaust Steam as the Heating Medium.

—may be a pastime for some folks, but for the Sims Company it is a serious proposition—a matter requiring a thorough knowledge of hot water requirements.

A long study of these requirements enables us to offer heaters that assure constant and efficient hot water service.

Engineers feel safe in specifying "SIMS" because they know it means **reliability**—a service you want to render your client.

SIMS CLEAN E-Z STEAM TUBE STORAGE HEATER

Our Engineers will gladly confer with you, without obligation, on your hot water problems.

THE SIMS CO.

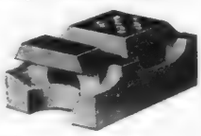
Erie, Pa.

A good place to live, to work and to play.

Well Heated Buildings Are Well Rented

The high efficiency of PYRAMID GRATES assures satisfactory heating.

Also economical because PYRAMID GRATES burn Buckwheat Coal.



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PYRAMID IRON PRODUCTS CO.
136 Liberty Street **New York City**

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in
Heating and Ventilating Engineering
(By Mail)

Our Course HB
is devoted entirely to
Gravity Steam and Water Heating
Our Literature on Request

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KIELEY
REGISTERED TRADE MARK

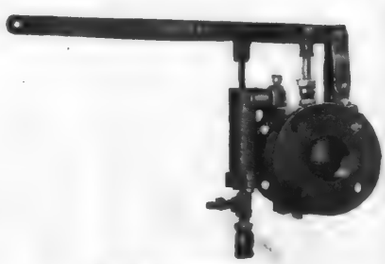
Steam, Water and Air Specialties

Grease Extractor

Manufacturers of the Complete Line

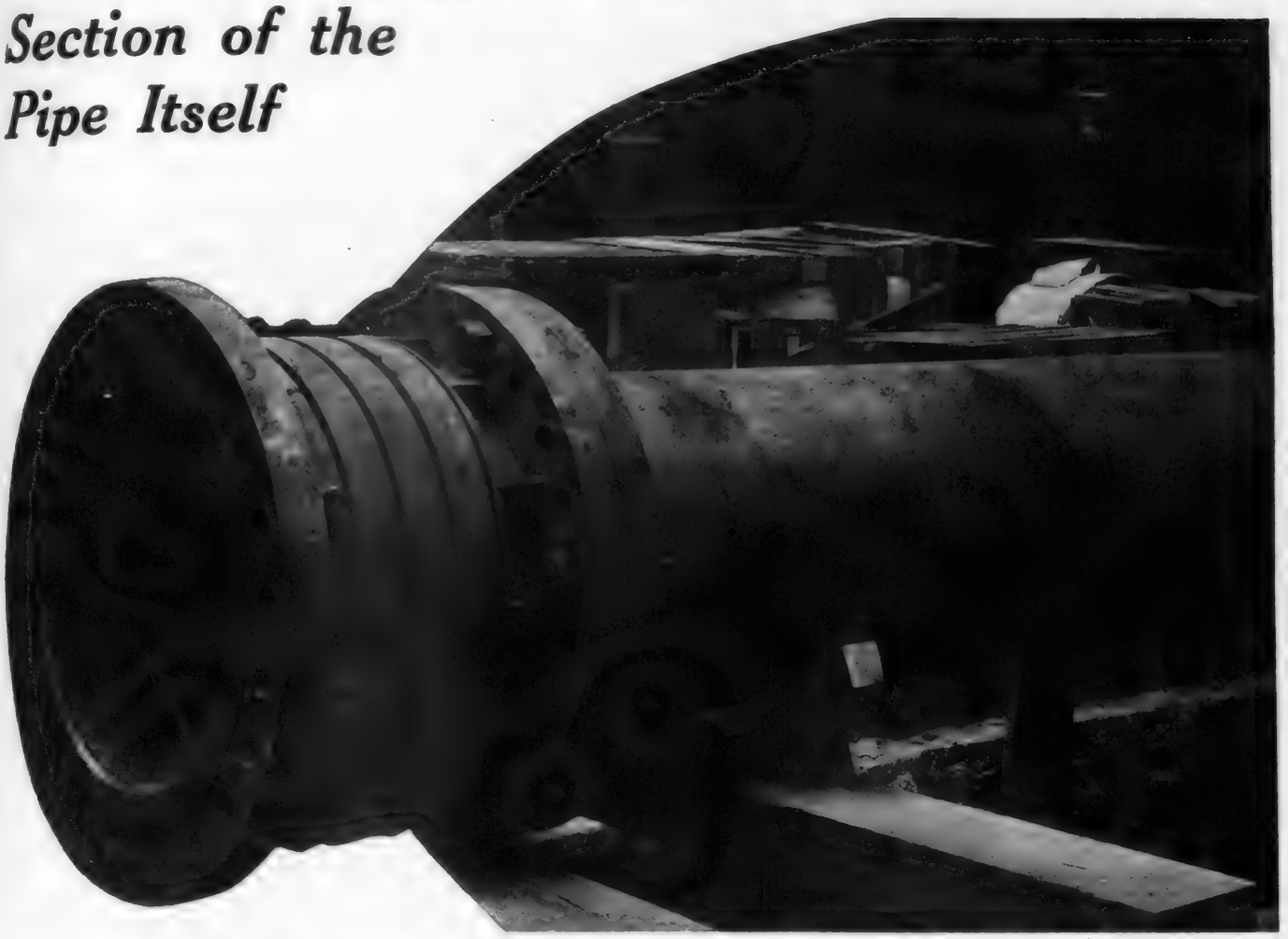
Send for Catalog 1923

KIELEY & MUELLER, Inc.
Main Office and Works
34-38 West Thirteenth Street
New York, N. Y.



Back Pressure Valve

A Corrugated Copper Expansion Joint that can be Installed like a small Section of the Pipe Itself



Service

To complete the cycle of Badger efficiency we offer, without obligation, the services of our Engineering Department in selecting the right joint for each Badger installation. This service is based on eighty-three years' experience in the manufacture of metal specialties.

BESIDES embodying all the requirements demanded of an expansion joint, the Badger Self-Equalizing Expansion Joint boasts of many distinct advantages.

Among these features are its compactness and ease of installation. The above illustration shows a Badger Self-Equalizing Expansion Joint ready for installation in one of the biggest high pressure steam jobs in New York City. Note that this expansion joint requires no more space than the pipe itself and that the installation necessitates merely the bolting in place like a small section of the pipe itself.

Before recommending your next expansion joints, let our engineers explain Badger advantages—one piece, no packing or adjusting, equal expansion, elimination of leaks, ease of installation, proper depth of corrugations, and many other.

ESTABLISHED 1841 · WEATHER VANE ON FANEUIL HALL · TRADE MARK · E·B·BADGER & SONS COMPANY

E.B. BADGER & SONS COMPANY

75 PITTS STREET, BOSTON, U.S.A.

Branch Offices in principal Cities

BADGER QUALITY

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.
Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N.J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc., W. L. New York.
Grinnell Company, Providence, R. I.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Filters, Inc., New York.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLING AND DRYING SYSTEMS.
Aerofin Corp., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N.J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc., W. L., New York
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Filters, Inc., New York.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Stickle Steam Specialties Co., Indianapolis, Ind.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.
Jas. P. Marsh & Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Midwest Air Filters, Inc., New York.

AIR FILTERS.
Midwest Air Filters, Inc., New York.
Reed Air Filter Co., Inc., Louisville, Ky.

AIR SEPARATORS.
Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Badger & Sons Co., E. B., Boston, Mass.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower Co., Inc., New York.
Fleisher Co., Inc., W. L. New York.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.

BLOWERS
Fan.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Pressure.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Turbine.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

BOILER CEMENT.
Johns-Manville, Inc., New York.

BOILERS.
Down-Draft.
American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
General Boilers Co., Waukegan, Ill.
Hart and Crouse, Utica, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Stanwood Corporation, Cincinnati, Ohio.
Universal Smokeless Boiler Co., Ravenna, O.

Heating.
American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Continental Heater Corp., Dunkirk, N. Y.
Cox Stove Co., Abram, Philadelphia, Pa.
General Boilers Co., Waukegan, Ill.
Gorton & Lidgerwood Co., New York.
Grinnell Company, Providence, R. I.
Gurney Heater Mfg. Co., Boston, Mass.
Handon Boiler Corp., New York.
Heggie Simplex Boiler Co., Boston, Mass.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Newport Boiler Co., Chicago, Ill.
Niagara Radiator & Boiler Co., North Tonawanda, N. Y.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Ross Boiler Co., Chicago, Ill.
Stanwood Corporation, Cincinnati, Ohio.
Thatcher Furnace Co., Newark, N. J.
Titusville Iron Works, Titusville, Pa.
Utica Heater Co., Utica, N. Y.
Wayne Heater Corp., Richmond, Ind.
Weil-McLain Co., Chicago, Ill.

Power.
Heggie Simplex Boiler Co., Joliet, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Ross Boiler Co., Chicago, Ill.
Stanwood Corporation, Cincinnati, Ohio.
Titusville Iron Works Co., Titusville, Pa.

CALORIMETERS.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Sarco Co., New York.

COILS, PIPE.
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
National Pipe Bending Co., New Haven, Conn.
Simmons Co., John, New York.

Air.
New York Blower Co., Chicago, Ill.

CONDENSERS.
Alberger Heater Co., Buffalo, N. Y.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

CONVERTERS, HOT WATER.
Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
National Pipe Bending Co., New Haven, Conn.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.
Wyckoff & Son Co., A., Elmira, N. Y.

COOLERS.
Oil.
Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
National Pipe Bending Co., New Haven, Conn.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLING TOWERS.
Badger & Sons Co., E. B., Boston, Mass.
Cooling Tower Co., Inc., New York.

COPPER BOILERS.
Dahlquist Mfg. Co., Boston, Mass.

COPPER KETTLES.
Dahlquist Mfg. Co., Boston, Mass.

COVERING PIPE.
American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A, Elmira, N. Y.

DAMPERS, DUCT.
American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.

DEHUMIDIFYING APPARATUS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Engineering Corp., Newark, N. J.
Fleisher Co., Inc., W. L., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

DISTILLERS, (Water).
Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.

DRAFT APPLIANCES.
Combustion Specialties, New York.
Crown Fuel Saver Co., Richmond, Ind.
Simmons Co., John, New York.
Wolff Coal Saver Co., Chicago, Ill.

DRYING SYSTEMS.
(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, New York.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

DUST COLLECTORS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Co., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F. Hyde Park, Mass.

DUST DETERMINATORS.
Atmospheric Conditioning Corp., Phila., Pa.
Hill, E. Vernon Co., Chicago, Ill.

ENGINES.
Steam, Automatic.
American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Stanwood Corporation, Cincinnati, Ohio.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.
American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

EQUALIZING LOOPS.
Hoffman Specialty Co., New York.

EVAPORATORS.
Boiler Feed Make-Up.
Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

EXHAUST SYSTEMS.
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wing Mfg. Co., L. J., New York.

EXHAUST HEADS.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons Co., John, New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wright-Austin Co., Detroit, Mich.

YOUNG VACUUM PUMPS

Ample Air and Water Capacity

Every Young Pump can deliver to boiler four times its rated capacity on peak load. This is more than ample to take care of any ordinary condition of operation.

Select vacuum pumps on performance, not on promises

A VACUUM pump is too important a piece of equipment to be purchased on the strength of promises of its probable performance. What it has done is of more moment than what is claimed for it.

Young Centrifugal Vacuum and Boiler Feed Pumps have an enviable record for the delivery of long-time and trouble-free service, under the varying conditions met with in vacuum heating. They are built of materials which insure maximum wear of the few moving parts. Their design is such that extreme simplicity combines with unusual sturdiness to give almost entire freedom from repairs.

Continuous operation, or automatic electric control—minimum operating attention—ample air and water capacity—are features of Young Pumps.

There is a Young Pump for every Vacuum Heating requirement. Capacities from 5,000 to 65,000 sq. ft. of direct radiation. Write us on your vacuum pump requirements.

A Few Typical Young Pump Installations

Standard Oil Office Bldg., Omaha, Neb.
Masonic Temple, Birmingham, Ala.
Cascade Apartments, Duluth, Minn.
Parkview Hotel, Memphis, Tenn.
United Fruit Co. Bldg., New Orleans, La.
John Crerar Library, Chicago
Orchestra Hall, Detroit, Mich.
Soreno Hotel, St Petersburg, Fla.
Insurance Bldg., Dallas, Tex.
Pensacola High School, Pensacola, Fla.
Westinghouse Elec. & Mfg. Co., Cleveland, O.
Columbus School, Rome, N. Y.

YOUNG PUMP COMPANY 230 East Ohio Street, Chicago

Factory: Michigan City, Ind.

ENGINEERS' SPECIFICATION INDEX (Continued)

EXPANSION JOINTS.
American District Steam Co., No. Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Dahlquist Mfg. Co., Boston, Mass.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Howard Iron Works, Buffalo, N. Y.
Illinois Engineering Co., Chicago, Ill.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.
Wheeler Condenser & Engineering Co., Carteret, N. J.

EXPANSION SHELLS
Phillips Drill Co., Chicago, Ill.

FANS, EXHAUST.
Amercan Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

FEEDERS
Boiler
Kieley & Mueller, Inc., New York.
McDonnell & Miller, Chicago, Ill.
Taylor Machine Works, Battle Creek, Mich.

FILTERS, (Aerating).
Griscom-Russell Co., New York.

Feed-Water.
Elliot Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED.
American District Steam Co., No. Tonawanda, N. Y.
Clow and Sons, Jas. B., Chicago, Ill.
Grinnell Company, Providence, R. I.
Simmons Co., John, New York.

FLANGES.
American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.

FLOOR SLEEVES.
Farley Sleeve & Hanger Co., Cleveland, Ohio.

GAS BURNERS
Cleveland Gas Burner & Appliance Co., Detroit, Mich.

GASKETS, METALLIC.
Sarco Co., New York.

GAUGE BOARDS.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.
Altitude.
Pierce, Butler & Pierce Corp., New York.

Draft.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Hydraulic.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Ounce Graduated.
Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.

Pressure.
American Dist. Steam Co., North Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Bishop & Babcock Co., Cleveland, Ohio.

Vacuum.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum (Compound).
Cashin Co., W. D., Boston, Mass.
Pierce, Butler & Pierce Corp., New York.

Water.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenburg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bristol Co., Waterbury, Conn.
Jenkins Bros., New York.

GENERATOR COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

GOVERNORS, (Pump).
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Stickle Steam Specialties Co., Indianapolis, Ind.
Westinghouse Elec. &. Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRATES
Dumping
Pyramid Iron Products Co., New York.

Rocking
Pyramid Iron Products Co., New York.

Shaking
Pyramid Iron Products Co., New York.

Shaking and Dumping
Pyramid Iron Products Co., New York.

Shaking, Circular
Pyramid Iron Products Co., New York.

Stationary
Pyramid Iron Products Co., New York.

HEATERS.
Domestic Water.
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Dahlquist Mfg. Co., Boston, Mass.
Everhot Heater Co., Detroit, Mich.
Excelso Specialty Works, Buffalo, N. Y.
National Pipe Bending Co., New Haven, Conn.
Page Boiler Co., Wm. H., New York.
Patterson-Kelley Co., New York.
Pierce, Butler & Pierce Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Thermal Appliance Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Closed).
Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims Co., Erie, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Open).
Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.
Alberger Heater Co., Buffalo, N. Y.
American Blower Co., Detroit, Mich.
Griscom-Russell Co., New York.
National Pipe Bending Co., New Haven, Conn.
Ross Heater & Mfg. Inc., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

Air, Fan System.
Aerofin Corporation, Newark, N. J.
American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Portable Unit Air.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Pecco Incorporated, St. Louis, Mo.
Skinner Bros. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
L. J. Wing Mfg. Co., New York.
(See also Ventilators, Portable Unit.)

HEATING SYSTEMS.
"Gasteam".
James B. Clow & Sons, Chicago, Ill.

Vacuum.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Vapor.
American District Steam Co., No. Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Grinnell Company, Providence, R. I.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane & Co., La Crosse, Wis.
Vapor Heating Co., York, Pa.
Webster & Co., Warren, Camden, N. J.

Water.
Grinnell Company, Providence, R. I.
Thrush & Co., H. A., Peru, Ind.

HUMIDIFIERS
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Grinnell Company, Providence, R. I.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

HUMIDITY CONTROL.
American Blower Co., Detroit, Mich.
Atlas Valve Co., Newark, N. J.
Atmospheric Conditioning Corp., Phila, Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Foxboro Co., Inc., The Foxboro, Mass.
Grinnell Company, Providence, R. I.
Klipfel Mfg. Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

INCINERATORS
Home Incinerator Co., Milwaukee, Wis.

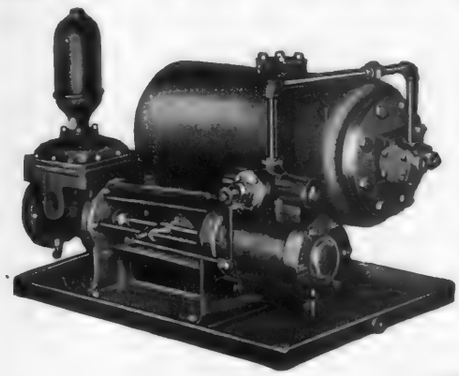
INSTRUMENTS
Electric Measuring.
Bristol Co., Waterbury, Conn.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.

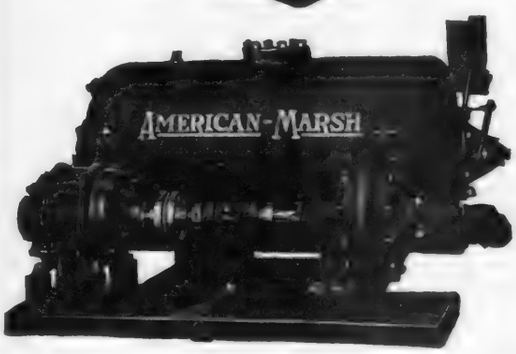
Indicating and Recording.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bailey Meter Co., Cleveland, O.
Foxboro Co., Inc., The Foxboro, Mass.
Hill, E. Vernon Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburg, Pa.

INSULATING MATERIALS.
American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Union Fibre Co., Winona, Minn.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.

AMERICAN-MARSH CONDENSATION PUMPS





Steam and Motor Driven

The American-Marsh line of pumps for heating systems includes:

Boiler Feed Pumps

Vacuum Pumps, steam and motor driven

Hot Water Circulating Pumps

Sump or Bilge Pumps

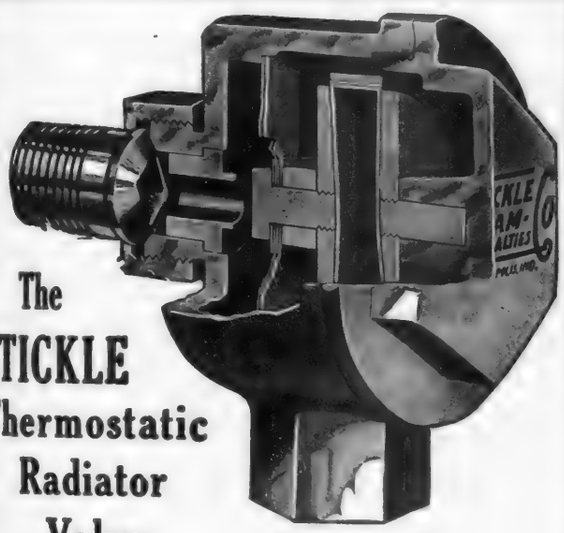
Condensation Pumps, steam and motor driven, vertical and horizontal

Automatic Boiler Feed Pumps and Receivers

American-Marsh Pumps are the result of over 35 years experience in the building of high grade pumping machinery. There are over 165,000 in actual operation. Every pump is made with only the very best of material and workmanship and combine reliability with highest efficiency.

Ask for bulletins covering the types in which you are interested.

AMERICAN STEAM PUMP COMPANY, BATTLE CREEK, MICH.



The STICKLE Thermostatic Radiator Valve

The Expansion principle in return line Radiator Traps is not novel or new. Consequently the difference in this class of Traps is in the construction.

The expansive movement of this diaphragm is fully one-quarter inch, which is much more than is necessary for opening and closing the valve. This gives a factor of safety which is greater than any valve made, consequently it requires no adjustment. May we send you our bulletin?

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INDIANAPOLIS, IND.

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Boston Office 52 Sudbury St.

YEOMANS

YEOMANS PUMPS GIVE YEOMAN SERVICE

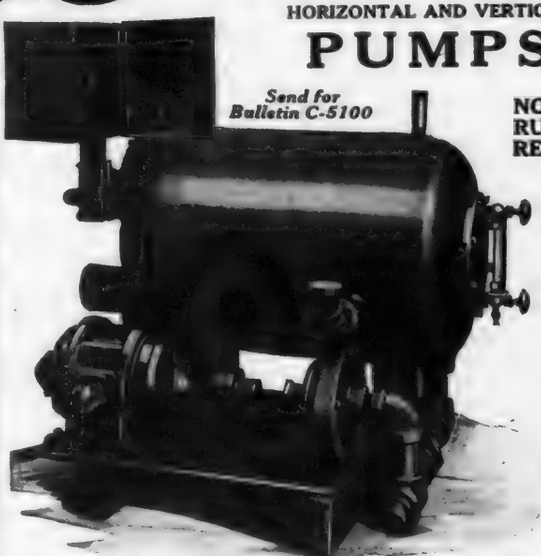
AUTOMATIC ELECTRIC

CONDENSATION

HORIZONTAL AND VERTICAL

PUMPS

Send for Bulletin C-5100



NOISELESS
RUGGED
RELIABLE

For Gravity Return Heating System

Cast Iron Receiver

Continuous Base

Built to meet all pressure and capacity requirements.

YEOMANS BROTHERS CO.

1421 Dayton St. Representatives in all principal cities **Chicago, Ill.**

DEPENDABILITY

ENGINEERS' SPECIFICATION INDEX (Continued)

MECHANICAL DRAFT APPARATUS.
American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park Mass.
L. J. Wing Co., New York.

METERS.
Condensation.
American Dist. Steam Co., No. Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.

Feed Water.
Central Station Steam Co., Detroit, Mich.
Simmons Co., John, 11 Centre St., New York.

Feed Water (Weir Type).
Webster & Co., Warren, Camden, N. J.

Pitot Tube.
American Blower Co., Detroit, Mich.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.

MOTORS (Electric).
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

OIL BURNING EQUIPMENT
Johnson Co., S. T., Oakland, Cal.

OZONE APPARATUS.
Ozone Pure Airifier Co., Chicago, Ill.
United States Ozone Co., Scottdale, Pa.

PIPE.
Cast Iron.
Clow & Sons, Jas. B., Chicago, Ill.

Soil.
Simmons Co., John, 110 Centre St., New York.

Steel.
National Tube Co., Pittsburgh, Pa.
Simmons Co., John, 110 Centre St., New York.

Wrought Iron.
Simmons Co., John, 110 Centre St., New York.

Wood.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.
Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Grinnell Company, Providence, R. I.
National Pipe Bending Co., New Haven, Conn.
Simmons Co., John, 110 Centre St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING (Wood).
American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE HANGERS.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Simmons Co., John, 110 Center St., New York.

PIPE, POWER.
Grinnell Company, Providence, R. I.
Simmons Co., John, 110 Centre St., New York.

PUMPS.
Centrifugal.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Taylor Machine Works, Battle Creek, Mich.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Condensation.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

Rotary.
Nash Engineering Co., So. Norwalk, Conn.

Steam.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.

Turbine.
Nash Engineering Co., So. Norwalk, Conn.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yeomans Bros., Chicago, Ill.

Vacuum.
American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Elliott Co., Jeannette, Pa.
McAlear Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Skidmore Corp., Chicago, Ill.
Trane Co., La Crosse, Wis.
Weinman Pump Mfg. Co., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

RADIATOR BUSHINGS.
Metering.
Holley Engineering Co, Virginia, Minn.

RADIATOR COVERS.
Acme Radiator Shield Co., Cincinnati, Ohio.

RADIATOR HANGERS.
Farley Sleeve & Hanger Co., Cleveland, Ohio.
Gloeckle, Jr., A. F., Rochester, N. Y.
Grinnell Company, Providence, R. I.
Healy-Ruff Co., Minneapolis, Minn.
Pierce, Butler & Pierce Mfg. Co., New York.

RADIATORS.
"Gasteam."
James B. Clow & Sons, Chicago, Ill.

"Gaswater."
Clow & Sons, Jas. B., Chicago, Ill.

RADIATORS, STEAM AND WATER.
Aerofin Corp., Newark, N. J.
American Radiator Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Gurney Heater Mfg. Co., Boston, Mass.
Lyon Products Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Simmons Co., John, New York.

RECEIVERS.
Air.
American District Steam Co., No. Tonawanda, N. Y.
The Brownell Co., Dayton, Ohio.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.
Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Yeomans Bros., Chicago, Ill.

REGULATORS.
Boiler-Feed.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Thrush & Co., H. A., Peru, Ind.
Wright-Austin Co., Detroit, Mich.

Damper.
American Dist. Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago, Ill.
Bishop & Babcock Co., Cleveland, Ohio.
Davis Regulator Co., G. M., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Co., Chicago, Ill.
Nelson Co., H. W., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburgh, Va.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Thrush & Co., H. A., Peru, Ind.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

Pressure.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Foxboro Co., Inc., The Foxboro, Mass.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Stickle Steam Specialties Co., Indiapapolis, Ind.
Taylor Instrument Cos., Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.

Temperature.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Carrier Engineering Corporation, Newark, N. J.
Elliott Co., Jeannette, Pa.
Foxboro Co., Inc., The Foxboro, Mass.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

SEPARATORS.
Oil.
Elliott Co., Jeannette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Wright-Austin Co., Detroit, Mich.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Elliott Co., Jeannette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SPRAY COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Massachusetts Blower Co., Watertown, Mass.

SPRINKLER HEADS
C. S. B. Sprinkler Co., Boston, Mass.

STRAINERS.
Oil.
Elliott Co., Jeannette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.

Steam.
American Dist. Steam Co., No. Tonawanda, N. Y.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeannette, Pa.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Mason Regular Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co, Milwaukee, Wis.
Wright-Austin Co., Detroit, Mich.

Water.
American Dist. Steam Co., No. Tonawanda, N. Y.
Davis Regulator Co., G. M., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sarco Co., New York.

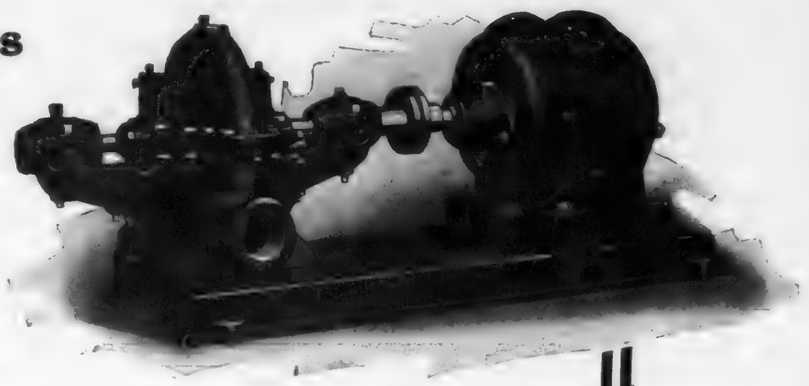
THERMOMETERS.
(Recording and Indicating).
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
Moto Meter Company, Inc., Long Island City, N. Y.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

Water.
Marsh & Co., Jas. P., Chicago, Ill.
Pierce, Butler & Pierce Corp., New York.

THERMOSTATS.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Fulton Co., Knoxville, Tenn.
Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Thrush & Co., H. A., Peru, Ind.

TRAPS.
Radiator.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D. Boston, Mass.
Dole Valve Co., Chicago, Ill.
Dunham, C. A., Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

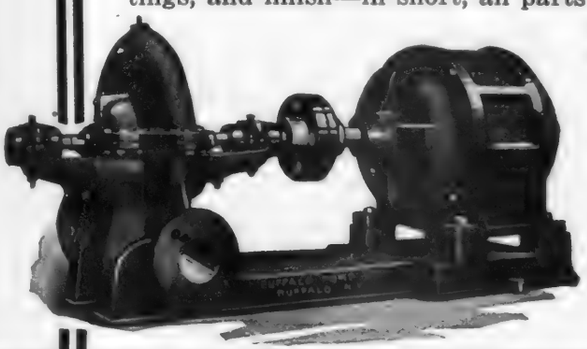
"Buffalo" Class "S" Pumps are favored—Because—



No other pump is so extensively used by air washer manufacturers, and no other so commonly specified on heating jobs.

This popularity is due to their efficient design, which enables them to "stay on the job"; and an additional advantage of a low price—which is, of course, the result of quantity production.

Horizontally divided casing, double suction hydraulically balanced impeller, brass clearance rings, large, properly lubricated bearings, stuffing boxes large enough to hold plenty of packing, water seals, sub-base, coupling, fittings, and finish—in short, all parts of Class "S" Pumps—are of such design and finish as to insure the best results possible.



And the price is low.

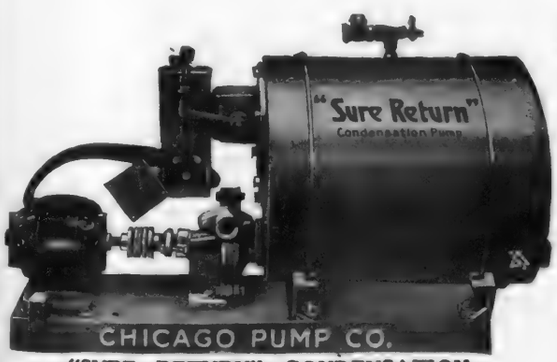
Send for Bulletin 55-36 for the whole story.

Buffalo Steam Pump Co.

480 BROADWAY BUFFALO, N. Y.

"CHICAGO" PUMPS

Give You HIGH QUALITY at a REASONABLE COST



"SURE RETURN" CONDENSATION PUMP
Ask for Bulletin 47.

The best workmanship and finest materials obtainable are used in building "Sure Return" Condensation and "L-1" Bilge Pumps — yet we are able to sell them at very low prices.

Hundreds of each size are put through our modern shop at one time—but each unit gets individual care and inspection. Thus you are assured of a reasonably-priced, proper working outfit.

Try a "Chicago" pump on your next hard job. You will like the result.

"L-1" BILGE PUMP
Ask for Bulletin 48

CHICAGO PUMP CO.

2332 Wolfram Street Chicago, Ill.

ENGINEERS' SPECIFICATION INDEX (Continued)

Return.
American Blower Co., Detroit, Mich.
Barnes & Jones, Boston, Mass.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago Ill.
Johns-Manville, Inc., New York.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburgh, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

Steam.
American Blower Co., Detroit, Mich.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeannette, Pa.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sarco Co., New York.
Simmons Co., John, New York.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.

Vacuum.
American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES (Steam).
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co. East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

TURBO-BLOWERS.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

UNDERGROUND PIPE CONDUITS.
American District Steam Co., No. Tonawanda, N. Y.
Hornung, P. C., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son, A., Elmira, N. Y.

VACUUM CLEANING APPARATUS.
American Radiator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

VACUUM PRODUCERS.
A. & P. Regulator Co., Park Ridge, Ill.

VALVES.

Air (Automatic).
American Radiator Co., Chicago, Ill.
Commonwealth Brass Corporation, Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Pierce, Butler & Pierce Corp., New York.
Russell & Co., W. A., New York.
Simmons Co., John, New York.

Air Relief.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Russell & Co., W. A., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Back Pressure.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
Stickle Steam Specialties Co., Indianapolis, Ind.

Balanced.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.

Blow-off.
Elliott Co., Jeannette, Pa.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

Check.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Float.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Grinnell Company, Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller Co., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Stickle Steam Specialties Co., Indianapolis, Ind.

Gate.
American District Steam Co., No. Tonawanda, N. Y.
Dole Valve Co., Chicago, Ill.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Globe, Angle and Cross.
Commonwealth Brass Corp., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Pierce, Butler & Pierce Corp., New York.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Hydraulic-Operating.
Atlas Valve Co., Newark, N. J.
Klippel Mfg. Co., Chicago, Ill.

Non-Return.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Davis Regulator Co., G. M., Chicago, Ill.
Grinnell Company, Providence, R. I.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Radiator.
American Radiator Co., Chicago, Ill.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Commonwealth Brass Corporation, Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
Powell Co., Wm., Cincinnati, O.
Russell & Co., W. A., New York.
Trane Co., La Crosse, Wis.
Simmons Co., John, New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Reducing.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powell Co., Wm., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.

Regulating.
American District Steam Co., No. Tonawanda, N. Y.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.

Relief (Water).
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, Ohio.

Safety.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Jenkins Bros., New York.
Powell Co., Wm., Cincinnati, O.

Stop and Check.
(See Valves, Non Return).

VENTILATING HEATERS

Portable Unit.
American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, Ohio.
H. W. Nelson Co., Moline, Ill.
Nesbitt, John J., Inc., Atlantic City, N. J.
Peerless Unit Ventilating Co., New York.
Stickle Steam Specialties Co., Indianapolis, Ind.
Sturtevant Co., B. F., Hyde Park Mass.
(See also Heaters, Portable Unit Air).

VENTILATING SYSTEMS
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila, Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
H. W. Nelson Co., Moline, Ill.
Nesbitt, John J., Inc., Atlantic City, N. J.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilating Co., New York.
Skinner Bros. Mfg. Co., St. Louis Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg Co., New York.

VENTILATORS.
Allen Air-Turbine Ventilator Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

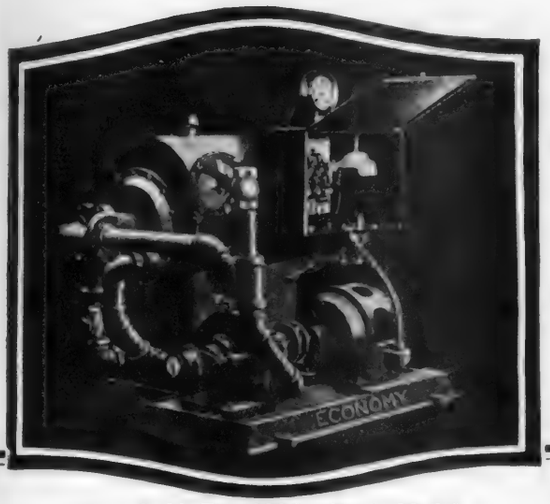
Mushroom.
Knowles Mushroom Ventilator Co., New York.
Lyon Products Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

WEATHER STRIPS.

Metal.
Athey Company, Chicago, Ill.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Higgin Manufacturing Co., Newport, Ky.
Monarch Metal Products Co., St. Louis, Mo.

WELDING MATERIALS.
Linde Air Products Co., New York.
Oxweld Acetylene Co., Long Island City, N. Y.
Prest-O-Lite Co., Inc., New York.

STEAM TRAPS
AIR TRAPS
STEAM SEPARATORS
EXHAUST HEADS
OIL SEPARATORS
BOILER ALARM WATER COLUMNS
STRAINERS
WRIGHT
AUSTIN
WRIGHT-AUSTIN CO.
DETROIT, MICHIGAN



Type C. V. Fig. 2234—Single Model Vacuum Pumps

DEPENDABILITY

This is an essential requirement of all apparatus entering into the equipment of every worth while project.

Economy Centrifugal Vacuum Pumps

embody every requisite of high class equipment. They are well motored with ample reserve power. They never burn out, consequently shut downs are avoided.

They have ample air, water and pressure capacity.

They have longer life than other types.

They maintain their efficiencies.

They are scientifically designed.

They have the best thought of competent hydraulic and heating engineers built into them.

They require less attention and upkeep than other types.

They reduce noise in radiators and piping.

They operate quietly.

They use no more power than other pumps that do the same work.

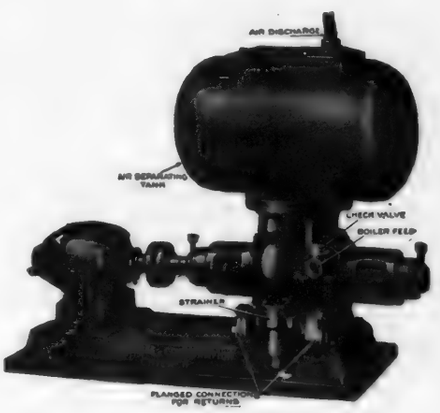
They are guaranteed for performance and quality.

Representatives in Every Large City

Economy Pumping Machinery Co.

71-122 North Curtis St. CHICAGO

SKIDMORE HYDRO TURBINE VACUUM AND BOILER FEED PUMP



SET THEM AS THEY COME CONNECT RETURNS, WIRE MOTOR AND RUN

Operates on a different principle.

Simple, Efficient and Sure.

Manufactured of highest grade material along lines of best engineering practice.

All parts are accurately machined.

The base, casing, bearing brackets and tank are fine-grained cast iron.

The shaft is Tobin Bronze carried on heavy ball bearings.

The air rotor and centrifugal pump are bronze castings.

The Skidmore occupies half the floor space required for other makes of pumps.

A self-contained unit requiring no piping

Engineers requiring the best and wanting a pump, the high efficiency of which remains constant, should specify the Skidmore.

Bulletin No. 2 will be sent on request.

Built in five sizes for 10 and 20 lbs. pressure to handle 8000, 16000, 26000, 40000, and 65000 sq. ft. of radiation, for continuous service or with automatic control.

SKIDMORE CORPORATION

General Offices and Factory

1535 Dayton St. CHICAGO, U. S. A.

ALPHABETICAL INDEX TO ADVERTISEMENTS

A

A-Em-Dee Engineering Co.. 144
Aerofin Corporation..... 120
Alberger Heater Co..... 136
American Blower Co..... 123
American District Steam Co. 31
American Radiator Co....11, 122
American Schaeffer & Budenberg Corp. 130
American Steam Pump Co.. 149
Ames Iron Works..... 8
Athey Co. 126
Atlas Valve Co..... 130
Atmospheric Conditioning Corp. 120
Autovent Fan & Blower Co.. 107

B

Badger & Sons Co., E. B.... 145
Barnes & Jones..... 37
Bayley Mfg. Co..... 135
Bishop & Babcock Co..... 44
Bristol Co. 124
Brownell Co. 134
Bryant Heater & Mfg. Co.. 23
Buckeye Blower Co..... 125
Buffalo Forge Co..... 133
Buffalo Steam Pump Co.... 151

C

Carrier Air Conditioning Co. of America 133
Carrier Engineering Corp... 134
Cashin Co., W. D..... 26
Central Station Steam Co.. 132
Chamberlin Metal Weather Strip Co. 137
Chicago Pump Co..... 151
Clarage Fan Co.....35, 36
Clow & Sons, James B..... 8
Commonwealth Brass Corp. 28
Continental Heater Corp.... 16
Cox Stove Co., Abram....42, 43
Crown Fuel Saver Co..... 140
C. S. B. Sprinkler Co..... 118

D

Dahlquist Mfg. Co..... 12
Davis Regulator Co., G. M.. 138
Dunham Co., C. A..... 24
Dwyer Equipment Co..... 128

E

Economy Pumping Machinery Co. 153
Elliott Co. 29
Everhot Heater Co..... 20
Excelso Specialty Works, Inc. 27

F

Foxboro Co., Inc., The..... 132
Fulton Co. 111

G

General Boilers Co..... 4
Gleockle, Jr., A. F..... 128
Gold Car Heating & Lighting Co. 124
Gorton & Lidgerwood Co... 14
Grinnell Co. 113
Griscom-Russell Co. 141
Gurney Heater Mfg. Co.... 6

H

Haines & Co., Wm. S..... 32
Handon Boiler Corp..... 39
Hart & Crouse Co..... 19
Healy-Ruff Co. 126
Heggie Simplex Boiler Co... 46
Higgin Mfg. Co. 124
Hoffman Specialty Co..... 156
Holley Engineering Co..... 142
Home Incinerator Co..... 34
Hornung, J. C..... 142

I

Ideal Heating Equipment Co. 132
Ilg Electric Ventilating Co.. 131
Illinois Engineering Co. Front Cover
Illinois Malleable Iron Co... 10
International Heater Co.... 9

J

Jenkins Bros. 28
Johns-Manville, Inc..... 109
Johnson Co., S. T..... 132
Johnson Service Co..... 48

K

Kennedy Valve Mfg. Co.... 138
Kewanee Boiler Co..... 5
Kieley & Mueller, Inc..... 144
Klipfel Mfg. Co..... 30
Knowles Mushroom Ventilator Co..... 118

L

Linde Air Products Co..... 38
Lyon Products Co..... 120

M

Marsh & Co., Jas. P..... 3
Marsh Valve Co..... 33
Mason Regulator Co..... 130
McAlear Mfg. Co..... 32
McDonnell & Miller 21
Midwest Air Filters, Inc.... 119
Minneapolis Heat Regulator Co. 130
Mount Vapor Heating Co... 26
Mueller Co. 115

N

Nash Engineering Co..... 106
National Pipe Bending Co.. 139
National Regulator Co..... —
National Tube Co..... 22
Nelson Corp., Herman..... 45
Nesbitt, Inc., John J..... 129
New York Blower Co..... 110
Niagara Radiator & Boiler Co. 10

O

O-E Specialty Mfg. Co..... 18
Oil City Boiler Works..... 3
Oxweld Acetylene Co..... —

P

Page Boiler Co., Wm. H.... 17
Patterson-Kelley Co. 141
Pecco Incorporated 118
Peerless Unit Ventilator Co. 108
Phillips Drill Co..... 128
Pierce, Butler & Pierce Mfg. Co. 8
Powell Co., Wm..... 138
Powers Regulator Co....105, 121
Prest-O-Lite Company, Inc. —
Pyramid Iron Products Co.. 144

R

Reed Air Filter Co., Inc.... 127
Ric-wiL Co. 143
Ross Boiler Co..... 2
Ross Heater & Mfg. Co.... 136

S

Sarco Co. 34
Scott Valve Co..... 30
Simplex Heating Specialty Co. 140
Sims Co. 144
Skidmore Corp. 153
Stanwood Corp. 142
Sterling Engineering Co.... 136
Stickle Steam Specialties Co. 140
Sturtevant Co., B. F..... 117
Supreme Heater & Ventilating Corp. 112

T

Taylor Instrument Cos..... 136
Taylor Machine Wks..... 12
Thatcher Furnace Co..... 139
Thrush & Co, H. A..... 18
Titusville Iron Works Co.. 18
Trane Co. 41

U

Union Fibre Co..... 154
United States Ozone Co.... 134
Universal Smokeless Boiler Co. 6
Utica Heater Co..... 15

V

Vapor Engineering Co..... 40

W

Want Ads..... 116
Wayne Heater Corp..... 139
Webster & Co, Warren.... 16
Weil-McLean Co..... 155
Wheeler Condenser & Engineering Co. 143
Whitlock Coil Pipe Co..... 14
Wing Mfg. Co., L. J..... 120
Wolff Coal Saver Co..... 7
Wolff Gas Radiator Co., A.H. 25
Wright-Austin Co..... 152
Wyckoff & Son Co., A..... 124

Y

Yeomans Bros. Co..... 140
Young Pump Co..... 147

Save Coal—Prevent Condensation

Insulate All Roofs

To the left: Boulevard Presbyterian Church, Cleveland, Ohio, **insulated** with **FIBROFELT.**
Architect: W. H. Nickles, Cleveland, Ohio.
Contractor: Phillip Kitzer, Cleveland, Ohio.

ALWAYS USE INTERNAL CONDUCTIVITIES, not air to air conductivities when figuring proper thickness for roof insulation. ASK US WHY?

Union Fibre Co., Inc.

Engineers and Manufacturers
WINONA, MINN.

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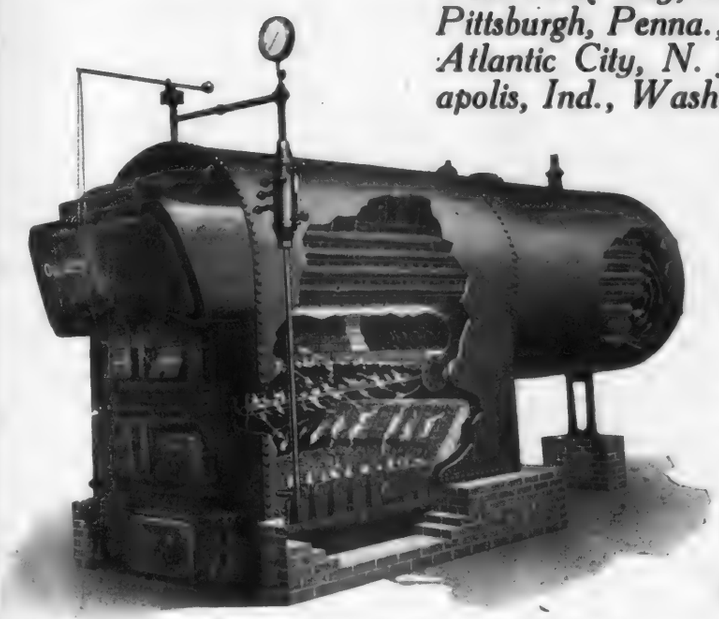
Why Do the Following Educational Boards Reorder Oil City Boilers?

New York City, N. Y., Los Angeles, California, Pittsburgh, Penna., Atlanta, Ga., Buffalo, N. Y., Atlantic City, N. J., Youngstown, Ohio, Indianapolis, Ind., Washington, D. C.



Built of Steel, in Accordance with the A. S. M. E. Code

THEY searched for enduring quality and economical performance, the best and cheapest service obtainable, and found these features in "Oil City" Boilers.

They found "Oil City" operation indispensable to successful production, and assured of this continued service, these educational boards, as well as many others, fulfill the increasing demands of their high production efficiency with "Oil City" Boilers.

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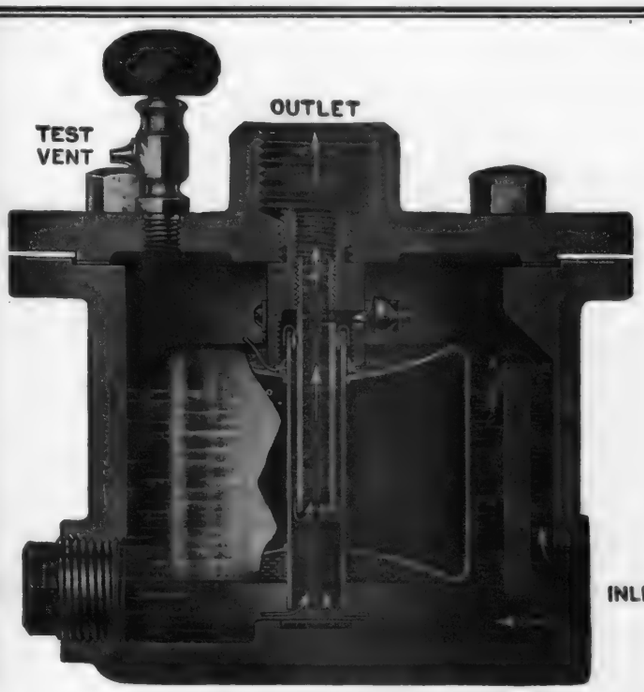
OIL CITY BOILER WORKS
OIL CITY, PA.

NEW YORK CHICAGO PITTSBURGH ATLANTA PHILADELPHIA LOS ANGELES



MARSH

DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

for direct or indirect coils or any location where large quantities of water are to be discharged

Operates automatically either with or without mechanical suction on return line.
No complicated parts to stick or get out of order.
No small openings to clog up with sediment or scale.
Free passage of water—rapid and steady vent of air and passes no steam.
Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.
Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

We Invite Correspondence

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago
FOUNDED 1865

Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents
Indicating and Recording Gauges

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Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

Performance Counts-

Read what this user found out about economy, efficiency, overload capacity of Pacific Boilers—

City Investment Company
Mission Consolidated Realty Company
Universal Company
San Christina Investment Company
United Bank and Trust Company Building
San Francisco, Cal.

San Francisco, Calif.
February 11th, 1925.

General Boilers Company,
330 Monadnock Bldg.,
San Francisco, Calif.

Gentlemen:-

Replying to your inquiry regarding the operation of the Pacific Steel boilers installed in the Claus Spreckels Building, this city, will say that I am very well satisfied with same.

The boilers are two No. 516, and fired from the rear. We expected at the time the boilers were installed that it would require both boilers to carry the entire heating load during real cold weather. However, up to the present time we have only used one boiler, and found no difficulty in handling the heating load and the domestic hot water for the building.

The month of December, of this year, was the coldest that we have experienced in some time, and it was not necessary at any time to use more than one boiler. The entire heating load on the building is 13,960 feet.

The consumption of oil during the month of December was 6745 gallons.

Before the installation of your boilers, we were using district steam, and in the month of December, 1923, the cost for heating the building was $556.47. For heating the building in December 1924, with your boilers and using fuel oil, our cost was $143.44.

Very truly yours,
Chas C. Cochrane
Chief Engineer
Claus Spreckels Building.

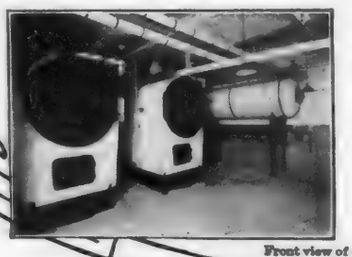
CCC/GM

STEEL HEATING BOILERS
PACIFIC
WAUKEGAN ILLINOIS
TRADE MARK REG. U.S. PAT. OFF.

Rear view of boilers showing rear firing oil burner attachment.

THE Pacific Boilers giving this unusual heating service are shown below the building. Note that they are rear fired oil burning Pacific Boilers. Elements of combustion travel practically twice the length of the fire box before passing into the lower banks of tubes. This, with the extra large fire box construction, gives maximum combustion space and permits extraction of every ounce of heat energy from the atomized oil. Pacific Boilers also may be equipped for front firing. Let us send you complete information.

GENERAL BOILERS COMPANY, *Waukegan, Illinois*
BRANCH OFFICES IN ALL PRINCIPAL CITIES



Front view of Pacific Installation.

PACIFIC
STEEL HEATING BOILERS

Why are KEWANEE FIREBOX BOILERS selected for heating fine buildings?

Second

BECAUSE their heating service is backed by a concern that realizes its responsibility to its clients.

And

they last as long as the fine buildings they heat.

MASONIC TEMPLE, DAVENPORT, IOWA

Architects, Clausen & Kruse, Davenport, Iowa. *Heating Contractors*, Mehring & Hansen, Chicago

Three Kewanee Smokeless Firebox Boilers No. 320

KEWANEE BOILER COMPANY

KEWANEE, ILLINOIS

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Chattanooga	Dallas	Grand Rapids	Milwaukee	St. Louis	Spokane
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Dominion Kewanee Boiler Company, Ltd., Toronto, Ont

Gurney

Sectional Boilers
Steam and Water
900 Series

No. 935 STEAM BOILER
Also for Water

As a result of unusual exhaustive tests to eliminate the defects usually found in push nipple square sectional boilers, the 900 Series Boilers represents the embodiment of many advantages not found in other boilers.

Low water line meets requirements where head room is limited.

Made in four widths of grates covering a wide range of sizes, suitable for both small requirements as well as the larger class of work requiring a battery of two or more boilers.

Generous grate areas, large prime fire surfaces and unusual coal carrying capacity. Highest grade pig iron is used to produce greatest tensile strength. Steam boilers have liberal steam space.

Well arranged heating surfaces, ample flue areas, ease in cleaning, rocking and dumping type grates, all help in giving the owner economical and satisfactory service.

GURNEY HEATER M'F'G COMPANY.

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Manly St., Cor. Anable Ave. Long Island City	93-95 Oliver St., Fort Hill Square	108 North 17th St.

You would be surprised to see the very small amount of ashes you get out of a Universal, 100% water tube double-grate, down-draft Smokeless Boiler.

Investigate the Universal

I GET SO LITTLE ASHES OUT OF DIS HERE UNIVERSAL SMOKELESS BOILER DAT I WAS JUST TRYIN' TO FIND OUT WHERE DEY ALL GOES.
"FUR THE LUVA MIKE" MOSE! WHAT YOU DOIN' INSIDE THAT BOILER?
ASHES

The elimination of all return flues in the Universal Boilers marks the greatest advance in heating boiler construction of the last 50 years.

The vertical cast-iron water tubes are largely self-cleaning. It is only necessary to clean our boilers two or three times a year.

UNIVERSAL SMOKELESS BOILER CO.

Factory and Main Office, Ravenna, Ohio

More Heat—with Less Fuel
WOLFF DRAFT CONDITIONERS

Enable even an unskilled man to operate any boiler at its greatest efficiency

NO matter how fine the boiler, it can't get maximum efficiency if it hasn't proper regulation. Too much draft, or too little draft, cuts down its efficiency. **So the actual efficiency depends on the man who fires the boilers.**

Masonic Temple: 61st and Cottage Grove Ave., Chicago. Robert M. Hyde, Architect. Heated with four Kewanee Boilers equipped with Wolff Draft Conditioners.

Wolff Draft Conditioners have made a great "hit" with thousands of building owners because, they take the "human element" out of the job of firing a boiler.

They make it possible for an unskilled man to operate any boiler at its greatest efficiency.

That means they help to give buildings better heat, with less attention. And results have proved that they save so much coal that in a short time the **coal saving pays for their installation.**

It may sound too good to be true. But, we can prove it. **Why not "dare us" to prove it?**

Write us for full particulars.
Every heating contractor can make money installing them.

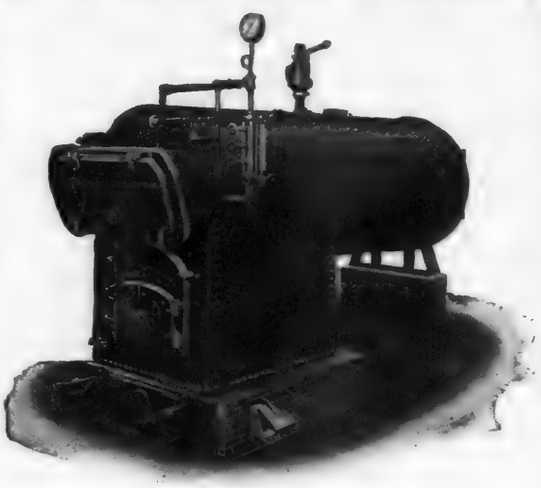
SALES REPRESENTATIVES CALLING ON ARCHITECTS, OWNERS and CONTRACTORS

We want a good representative in every city, not now covered, to sell Wolff Draft Conditioners to Architects, Heating Contractors and Owners. Write for our Agency Plan.

Wolff Coal Saver Co.

1336 West Congress St., Chicago

AMES
Firebox Heating Boilers



Ames Firebox Heating Boiler with Plain Furnace

Built with Plain and Downdraft Furnaces. Incorporating the Latest and Most Advanced Ideas in Boiler Design and Construction.

We also build a complete line of Horizontal Tubular, Upright and Empire Boilers for Heating and Power Requirements.

Bulletins with complete details mailed on request.

Empire Return Tubular Portable Boiler

AMES IRON WORKS
DIVISION OF
Pierce, Butler & Pierce Mfg. Corp.

Main Office & Works
Oswego, N. Y.

General Sales Office
41 E. 42nd St., New York City

While building or remodeling—install modern heating

STEAM HEAT AT THE TURN OF A VALVE—ON OR OFF IN A MINUTE

Clow Gasteam Radiators eliminate the central heating plant entirely. And they require no connection with water piping.

With Clow Gasteam Radiators you can turn the heat on or off instantly. Simply turn on the gas, and light a match, and you have steam heat.

Automatic Regulation

Moreover, Clow Gasteam Radiators are automatically regulated to maintain an unvarying steam pressure regardless of outside temperatures.

One hundred per cent of the fuel they use is converted into usable heat. You don't have to have a boiler, a coal bin, an oil tank or even a cellar to have Clow Gasteam heat.

All you need is a gas connection.

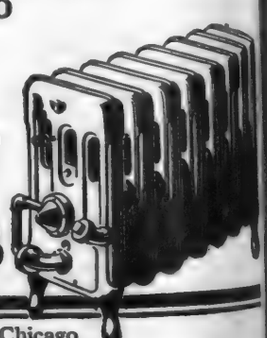
Thousands of Users

Clow Gasteam Radiators look like any other radiators, except possibly that they are more attractive in design. They are carefully built, carefully tested. They have twenty years' use back of them and over forty years of Clow experience and reputation.

Thousands of satisfied users everywhere. We can furnish you with a list covering this vicinity. Do you not want to know more about this modern, clean, convenient and healthful method of heating? Write or call us today.

JAMES B. CLOW & SONS
534-546 So. Franklin Street
CHICAGO

CLOW "GASTEAM" HEATING SYSTEMS



Mfd. by JAMES B. CLOW & SONS, Chicago

Heating Comfort—

That's what you are selling principally

YOUR next task is to convince of your ability and facilities to deliver that comfort. Failure to deliver it puts an awful dent in your local reputation as a heating engineer.

There is little time left for you to build a reputation for the boiler which is the very foundation of the whole works.

How necessary it is then to use a *well known* and *accepted* boiler!

THE INTERNATIONAL ECONOMY is such a boiler

Acceptance for Economy Boilers

is secured by continued advertising to nearly four million families; in city, suburban and farm markets.

They need no introduction.

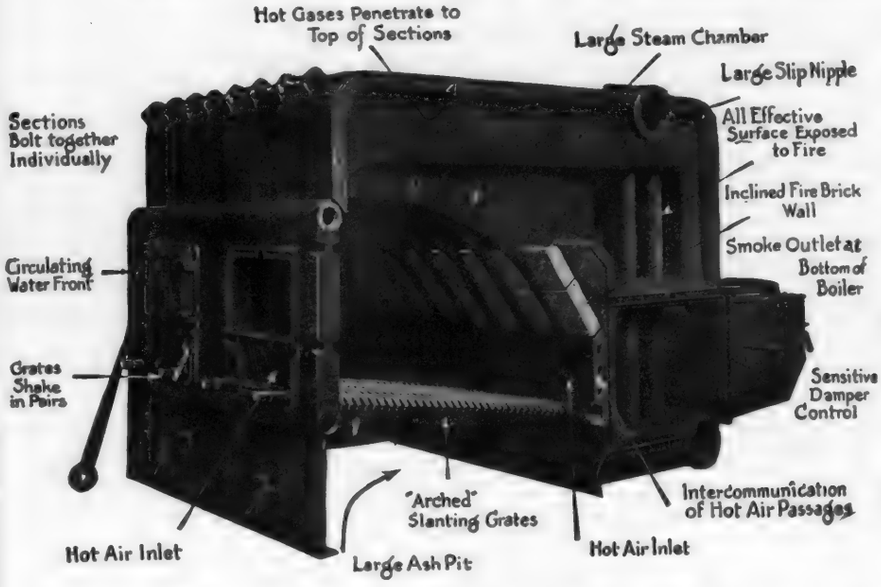
Send for Catalog No. 1740 H.

INTERNATIONAL HEATER COMPANY

UTICA, N. Y.

NEW YORK *CHICAGO* *CLEVELAND* *DETROIT* *NASHUA, N. H.*

Ask Us Why It's Economical to Use


Hot Gases Penetrate to Top of Sections
Large Steam Chamber
Large Slip Nipple
All Effective Surface Exposed to Fire
Inclined Fire Brick Wall
Smoke Outlet at Bottom of Boiler
Sensitive Damper Control
Intercommunication of Hot Air Passages
Hot Air Inlet
"Arched" Slanting Grates
Large Ash Pit
Hot Air Inlet
Sections Bolt together Individually
Circulating Water Front
Grates Shake in Pairs

A correct application of heat, over both a direct fire surface and a large amount of indirect surface, is necessary to an efficient boiler.

The result of complete combustion, assured — no matter what the fuel—by plenty of fresh, pre-heated air is almost entirely useful steam.

Waste gases enter the smoke pipe free from smoke and, even more important, comparatively cool.

NIAGARA RADIATOR & BOILER COMPANY

General Office and Factory—North Tonawanda, N. Y. Branch Office and Factory—Chicago, Ill.

NIAGARA LOW WATER LINE SMOKELESS BOILERS

IRON BODY GATE VALVES

SCREWED, FLANGED AND HUB END STYLES

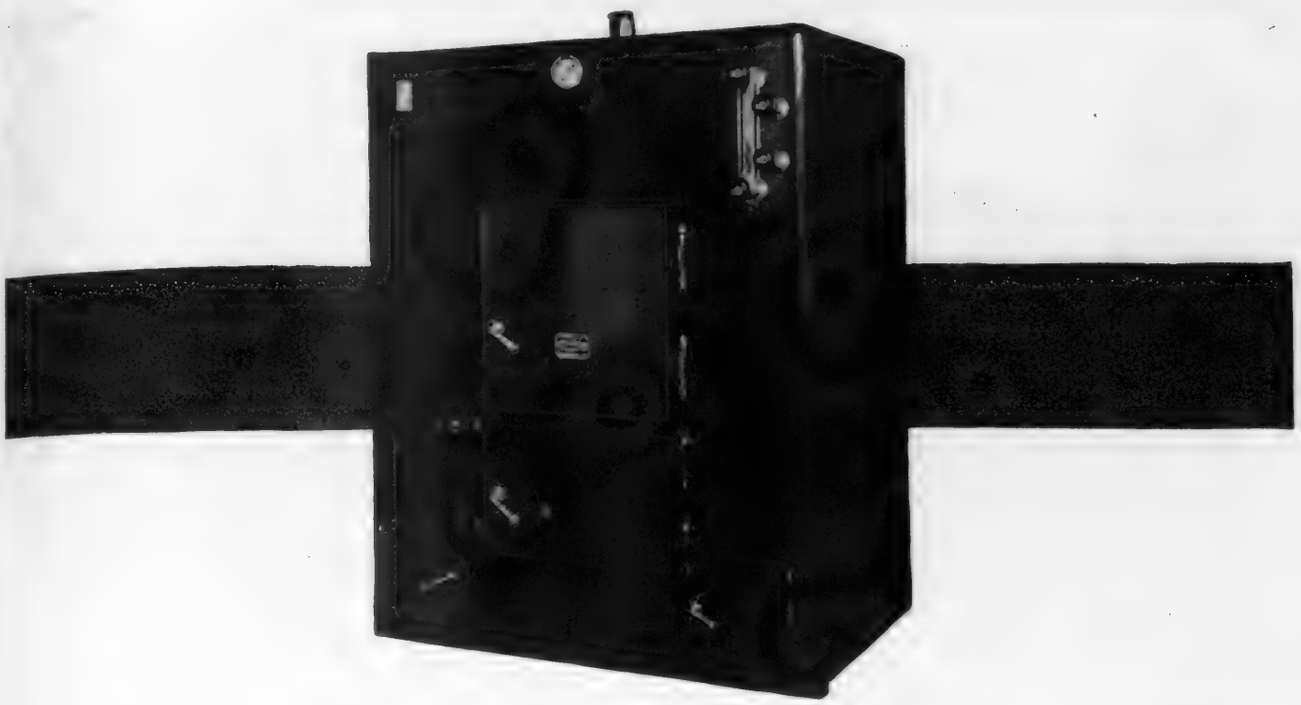
NON-RISING STEM AND O. S. and Y. PATTERNS

ALSO MANUFACTURERS OF

Cast and Malleable Iron Fittings

Illinois Malleable Iron Company

1801 Diversey Parkway :-: :-: Chicago, Ill.



How IDEAL Type A is adapted for oil

MANY an Architect and Engineer has asked us how IDEAL Type A can be specified with complete equipment ready for the installation of an oil burner.

The picture above shows the oil-burning Type A set up. Notice these changes from the coal-burning Type A:

1. The special front section is furnished with cross-waterway removed between clinker door and ash-pit door openings to give one large opening.
2. The automatic regulating system is removed, including the dial handle on the front; the damper door in the rear is permanently shut and a special jacket covers the openings left by the automatic control device.
3. Instead of the large lock-safe door, notice the two doors and the hole in the lower one, adjustable to fit any make of oil burner.
4. Grates and shaking mechanism are removed.

Any oil-burning Type A Boiler can readily be converted to coal burning if desired. Sizes, boiler numbers, ratings and other specification data for oil-burning Type A Boilers and IDEAL Water Tube Boilers are in the new booklet, "IDEAL Boilers for Oil Burning," pictured at the right. Address the office below if your copy has not been received.

Send for this book.

Every Architect and Engineer should have one. It contains a full description of the IDEAL Type A and IDEAL Water Tube Boilers and their adaptation for oil burning. Your name on your letter-head will bring you a copy.

AMERICAN RADIATOR COMPANY

Dept. T-138, 1807 Elmwood Avenue Buffalo, N. Y.

Sales Offices in all principal cities

IDEAL BOILERS AND AMERICAN RADIATORS FOR EVERY HEATING NEED

Hot Water—No Waiting!

WITH

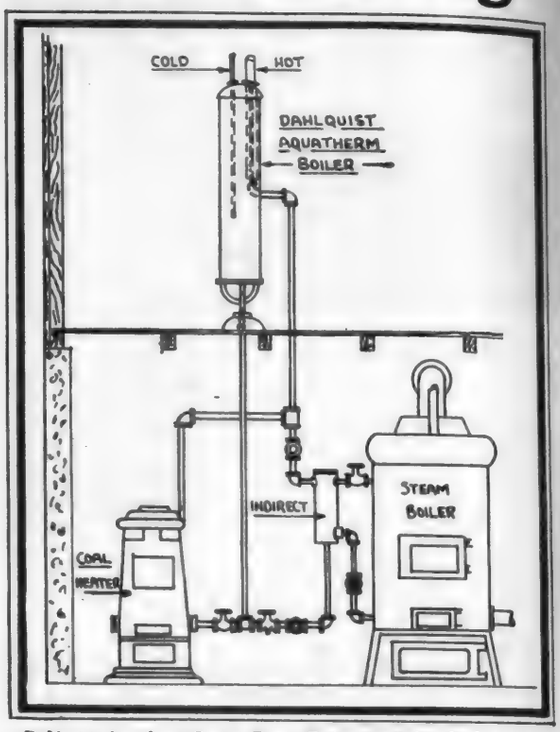
DAHLQUIST AQUATHERM COPPER RANGE BOILER

With a reduction of one-half the cost of installing a gas tank heater on any job, you can have the convenience of an instantaneous heater, either from the ordinary gas tank heater, water back in coal range, indirect heater or coil in boiler or furnace, or electric heater, by installing the **Dahlquist Aquatherm Copper Range Boiler.**

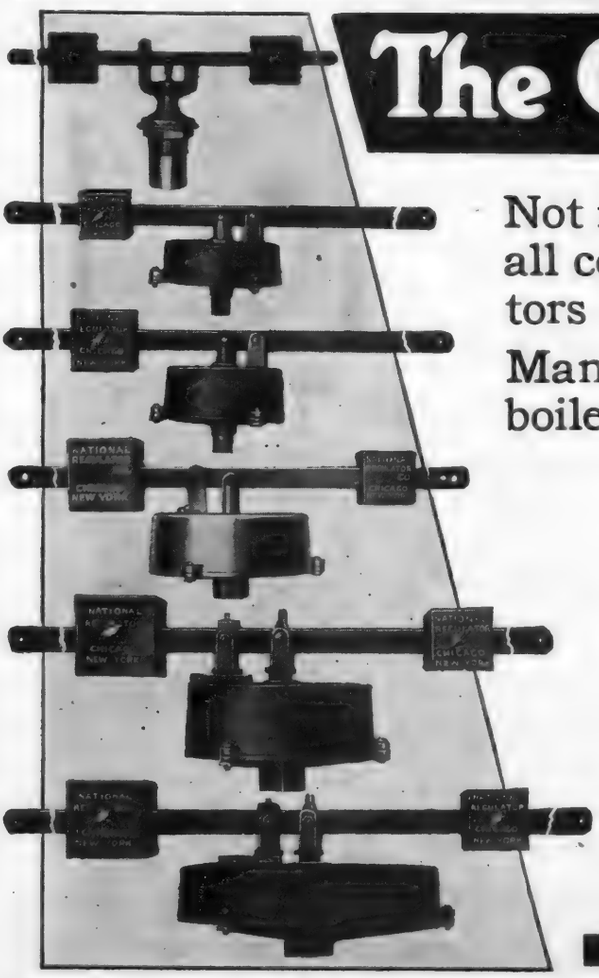
The **Dahlquist Aquatherm** can also be furnished separately in proper size for any range boiler now installed, whether heated by gas, coal, wood or electricity.

Let us send full details

DAHLQUIST MFG. CO.
40 W. 3rd St. BOSTON, MASS.



Dahlquist Aquatherm Copper Range Boiler installed in kitchen in connection with indirect water heater and coal fired water heater in cellar.



The Complete Line

Not merely one regulator to cover all conditions but a line of regulators to meet every requirement.

Manufacturers of the better boilers have standardized on

METAPHRAM DAMPER REGULATORS

Metal Diaphrams—Last the life of the boiler

For Low Pressure Steam—Vacuum—Vapor or Hot Water. Smallest to the largest Boilers.

Write for catalog—if your jobber cannot supply

NATIONAL REGULATOR CO.
2301 KNOX AVENUE CHICAGO
The A Jacks People (A Jacks for High Pressure)

METAPHRAM

Titusville Horizontal Return Tubular Boilers

A type that gives long and satisfactory service.

Built with liberal allowances for safety beyond actual requirements of A.S.M.E. Code.

Stock designs and sizes—or built to specifications. Steel Casings and suspension frames furnished when required.

WRITE FOR DESCRIPTIVE BULLETIN.

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Titusville, Penna.

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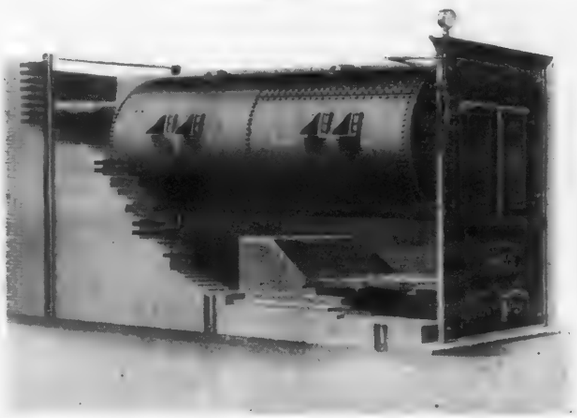

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TITUSVILLE *HORIZONTAL* *RETURN TUBULAR* BOILERS

William H. Hall High School
West Hartford, Conn.
WILLIAM T. MARCHANT, Architect
H. J. MILNER CO., Consulting Engineers
WHEELER AND MAHONEY
Plumbing and Heating Contractors

In the little red school house—

they didn't have hot water. But it is a far cry indeed from the little red school house and its needs to the splendid new William H. Hall High School and its modern equipment, shown above.

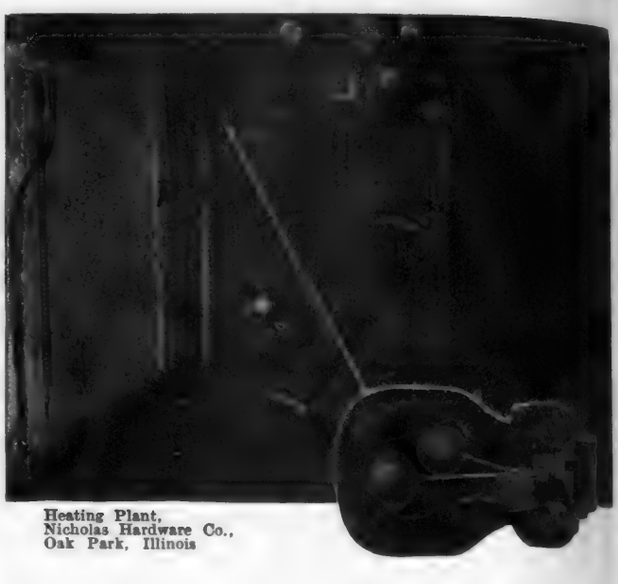
The "Three R's" of those days have been increased now to include Domestic Science, Chemistry, Physical Training and a hundred and one other courses which didn't worry our grandparents. Laboratories for the science courses and showers and swimming pools for the Physical Training courses have created the need for a reliable supply of hot water.

Whitlock Type "K" Storage Heaters supply hot water in this school and in hundreds of others. The experience gained in this practical way of installing Whitlock Heaters in so many schools will be of great value to you when you are figuring on a school building job.

To get the advantage of this experience, all you have to do is to 'phone or write, asking the nearest Whitlock Engineer to call.

THE WHITLOCK COIL PIPE CO.
40 South Street Hartford, Conn.
New York Chicago Boston Buffalo Philadelphia
Baltimore San Francisco

WHITLOCK
HEAT TRANSFER
PRODUCTS



Heating Plant,
Nicholas Hardware Co.,
Oak Park, Illinois

Is anything more necessary than water in the boiler?

The McDonnell & Miller Duplex Water Feeder maintains the correct volume of water in the boiler under all conditions, affording absolute protection against the damage due to low water—cracked sections and burned boilers.

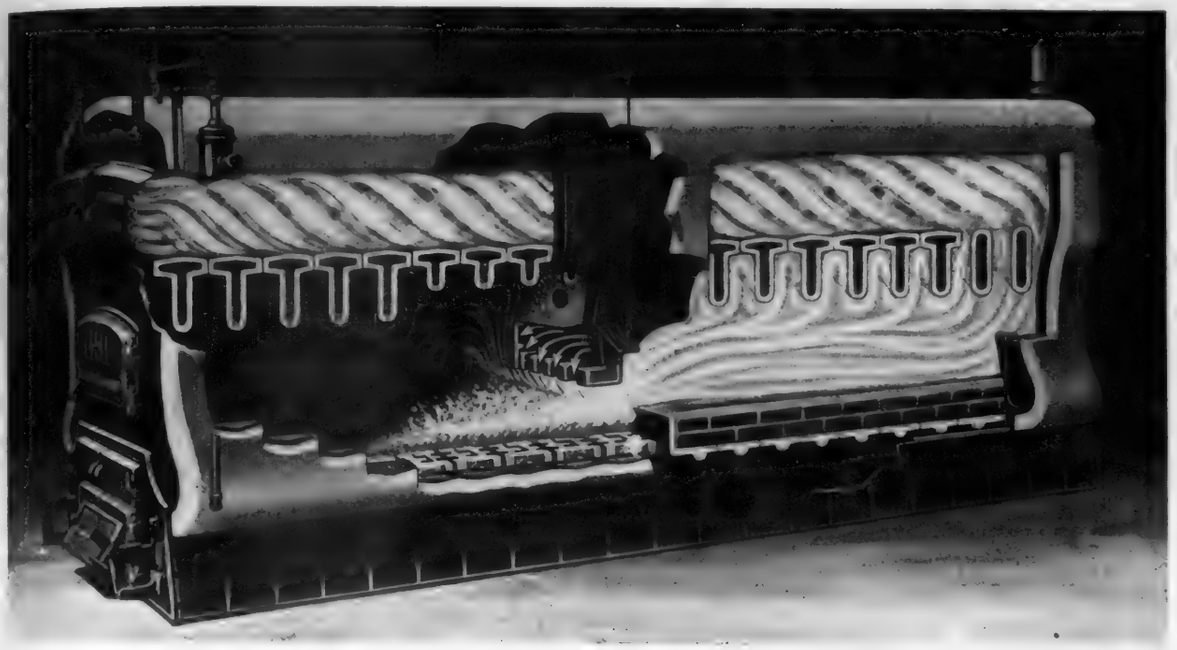
The overflow valve in the McDonnell & Miller Duplex Water Feeder prevents the water from rising above the maximum level for economical boiler performance. It disposes of any excess condensate which may be returned due to peculiarities in the system.

It is also essential protection on boilers depending upon electrically driven pumps for returning the condensation, because it insures the correct volume of water in the boiler in the event of current failure.

Write for Bulletin H-2

McDonnell & Miller
"Doing One Thing Well"

Wrigley Bldg. M&M WATER FEEDER Chicago



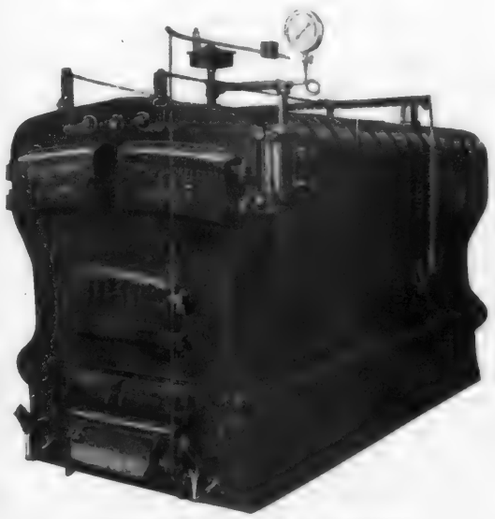
Cutaway View of Utica-Imperial SUPER-SMOKELESS Boiler

UTICA-IMPERIAL

SUPER-SMOKELESS BOILERS

The Standard of Smokeless Boilers!

A recent improvement put the Air Regulation under easy control from the front of the boilers.



Exterior View of Boiler

THE principle of admitting highly heated air for secondary combustion was first successfully applied in the SUPER-SMOKELESS Boiler. Although widely imitated in partial detail, the SUPER-SMOKELESS remains the only boiler in which this vital principle (fully protected by patents) is successfully used. It is to soft coal combustion what the Bunsen Burner is to gas and the carburetor to gasolene. No other boiler so completely solves the smoke problem. High in efficiency, easy to operate, elastic as to quality and type of fuel requirements, conservative in ratings, the SUPER-SMOKELESS stands in a class by itself—pre-eminent in the recognition of architects, engineers and contractors.

Manufactured by the

UTICA HEATER COMPANY

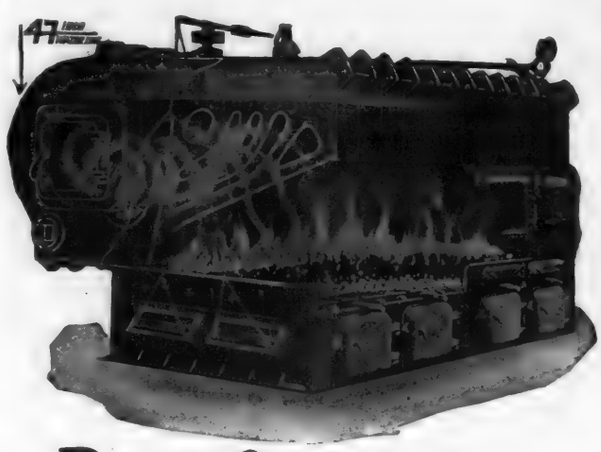
UTICA, New York

CHICAGO CLEVELAND NEW YORK

Sales Offices in the Principal Jobbing Centers

Continental

BOILERS AND RADIATORS



Built for better heating

and Why!

THE 43 and 47 inch water lines of the Continental Low Water Line Boilers make them ideal for the extraordinary installations as well as the ordinary.

Primarily, they are built for high boiler efficiency under every working condition. This is true because—

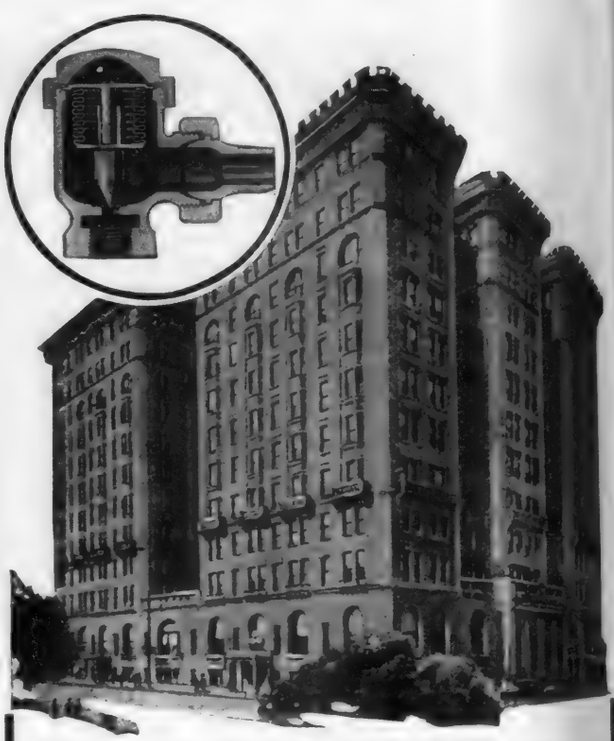
1. They are easy to fire
2. They hold a steady water line
3. They are quick steamers
4. They burn any kind of fuel including oil.
5. They get the most out of the fuel used.

Those are five reasons that tell why they are built for better heating. The complete story of Continental Boilers and Radiators is told in the Continental Book — have you a copy?

Continental Heater Corporation
Dunkirk, N. Y., U.S.A.

There is a Continental Boiler and Radiator for every use. This is the book that tells the Better Heating story—there is a copy waiting for you.

Built for better heating



Majestic Hotel, New York, Percy R. Owen, Engineer

This Building Has 1040

SARCO

Radiator Traps

The owners and engineer of this great hotel —ever alert to select everything that would make for the most economical and dependable operation—chose Sarco Radiator Traps because of their universally good reputation.

When leading architects and engineers have installed Sarco Radiator Traps in a large percentage of the better buildings throughout the country, further comment might seem to be useless.

Here are a few Sarco advantages. They are factory adjusted and noiseless in operation. Won't freeze nor air bind. Prevent water hammer. Are self-cleaning and easy to take apart.

We have described the Sarco's many advantages in our booklet P-121. Write for a copy.

SARCO CO., Inc.
231 Broadway, New York City

Boston Buffalo Chicago Cleveland Detroit Philadelphia
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PAGE BOILERS

"The Distinguished Service Line"

Monarch Smokeless Boiler
(Cutaway View)

You will be interested in the new Page Catalogue No. 51. Write us. We will gladly send you one.

This booklet gives complete and up-to-the-minute rating and dimensional data on all Page Boilers in the concise form desired by the heating engineer and contractor for the preparation of specifications.

Whatever type or size of building you must heat, there is a Page Boiler that will easily carry the load, with the minimum of attention and lowest fuel cost.

For All Fuels—
Hard Coal,
Soft Coal,
Gas or Oil.

There is a Page Boiler for every requirement—Volunteer Round and Monarch Square Sectional.

THE WM. H. PAGE BOILER CO.

58 West 40th Street
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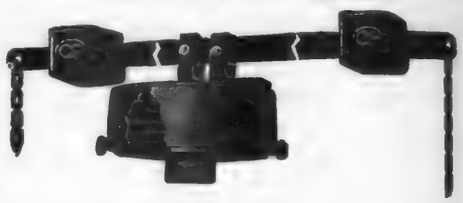
BOSTON **CLEVELAND**
PHILADELPHIA **MEADVILLE**

Established 1856 **Incorporated 1877**

THE O-E 3 IN 1 HEATING SPECIALTIES

TRADE O-E MARK

No. 2 "O-E" (3 IN 1) Regulator



Three Systems in One

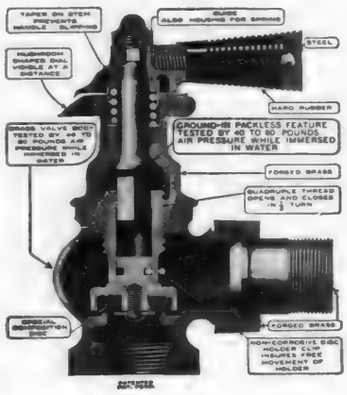
Vapor, part of the time.
Vacuum, most of the time.
Pressure, when wanted.

Insure Efficiency Heating

The O-E System of Heating is based on a thorough knowledge of heating requirements. Every part represents high grade manufacture and workmanship, and simplicity elimimates the possibility of trouble. Costs less to operate and gives more heat.

Our claim for high efficiency is not based entirely upon our own opinion of O-E performance. Severe tests by other experts have shown the O-E System superior to others, and testimony has been added to our claim by many whose buildings are O-E heated. Send for Catalog "A."

O-E Specialty Co., 12 Keefe Ave., Milwaukee, U. S. A.


TAPER ON STEM PREVENTS HANDLE SLIPPING
GUIDE ALSO HOUSING FOR SPRING
MUSHROOM SHAPED BALL VISIBLE AT A DISTANCE
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GROUND-IN PACKLESS FEATURE TESTED BY 40 TO 60 POUNDS AIR PRESSURE WHILE IMMERSED IN WATER
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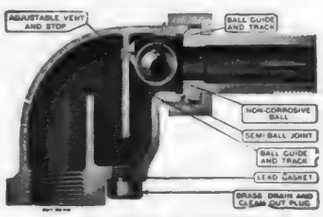
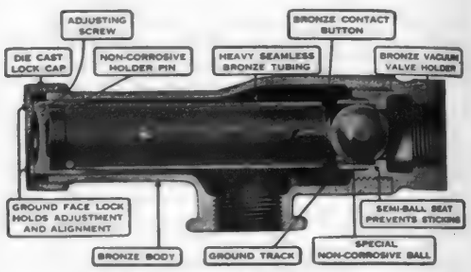
NON-CORROSIVE DISC HOLDER CLIP INSURES FREE MOVEMENT OF HOLDER

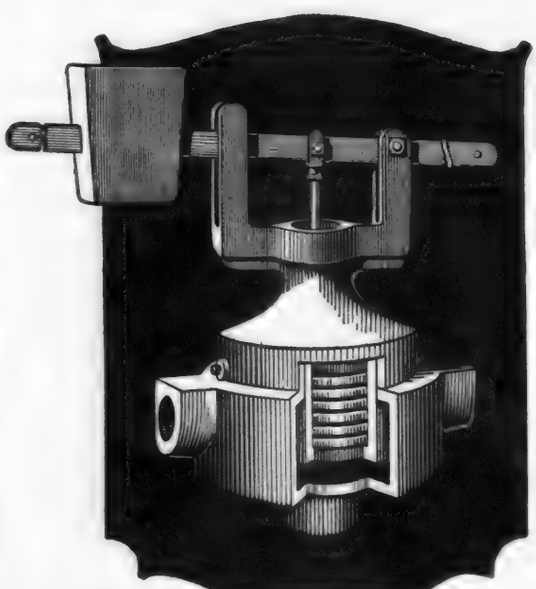
"O-E" Improved Perfect Packless Graduated Valve



"O-E" Perfect Ball-Check Water Seal Union Elbow with Adjustable Air Vent.



"O-E" Improved Air Exhauster and Vacuum Valve



Ha Thrush & Co

PERU INDIANA

Thrush Hot-Water Heating Systems

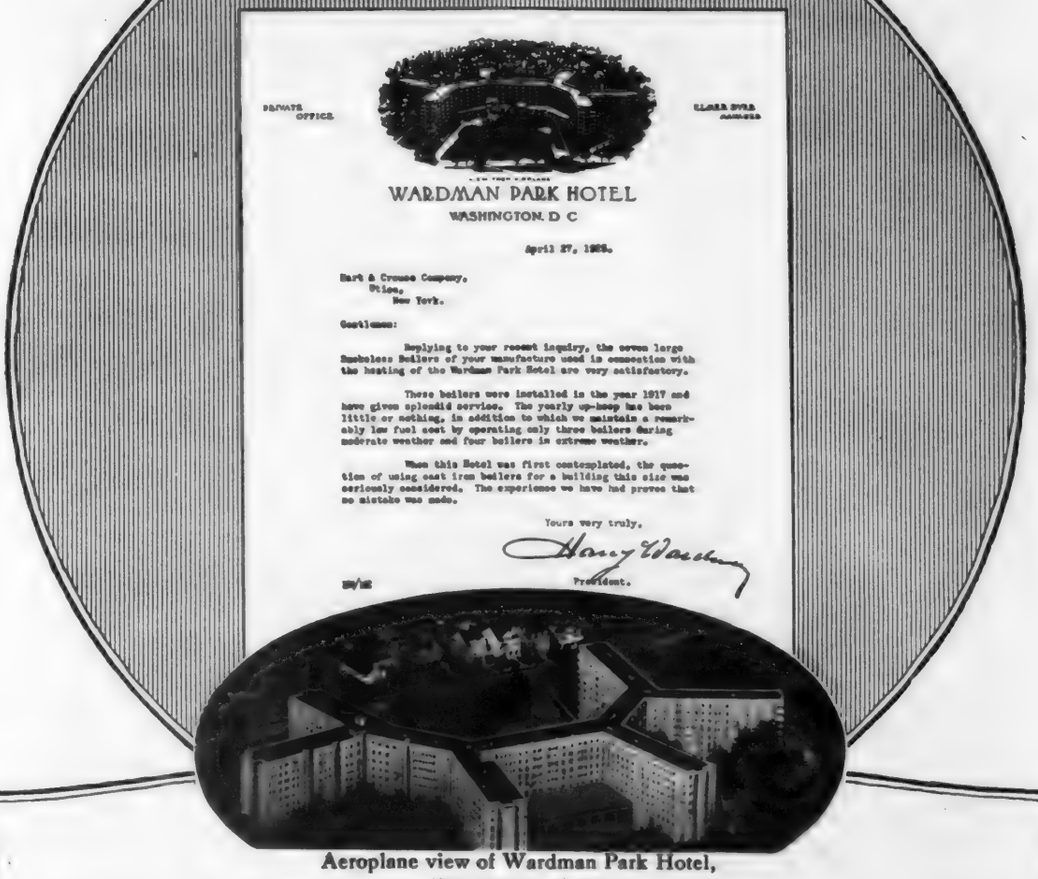
There's an ever increasing demand for efficient automatic regulation of hot water heating plants. Thrush System has demonstrated its ability to satisfy. It produces more heat where heat is desired with lower flue temperatures and less fuel. Because Thrush System is a closed system, and the tank goes in the basement, you can put it on old or new systems without tearing up walls or ceilings. Learn how you can build bigger business by the Thrush plan. Write today.

SAVE and SATISFY!

ROYAL

ROUND SECTIONAL and SMOKELESS BOILERS

—HART AND CROUSE—



WARDMAN PARK HOTEL
WASHINGTON, D C

April 27, 1923.

Hart & Crouse Company,
Utica,
New York.

Gentlemen:

Replying to your recent inquiry, the seven large Smokeless Boilers of your manufacture used in connection with the heating of the Wardman Park Hotel are very satisfactory.

These boilers were installed in the year 1917 and have given splendid service. The yearly up-keep has been little or nothing, in addition to which we maintain a remarkably low fuel cost by operating only three boilers during moderate weather and four boilers in extreme weather.

When this Hotel was first contemplated, the question of using cast iron boilers for a building this size was seriously considered. The experience we have had proves that no mistake was made.

Yours very truly,

Harry Wardman

President.

Aeroplane view of Wardman Park Hotel,
Washington, D. C.

ROYAL Boilers heat one of the largest Apartment Hotels in the world.

Read what Mr. Harry Wardman, owner and builder, has to say about them.

Six S-558 and one S-555 ROYAL Hart & Crouse Down Draft Smokeless Boilers are serving 70,000 square feet of radiation and supplying six 2,000 gallon hot water tanks.

Cosy Cottage
or
Soaring Skyscraper

HART & CROUSE COMPANY

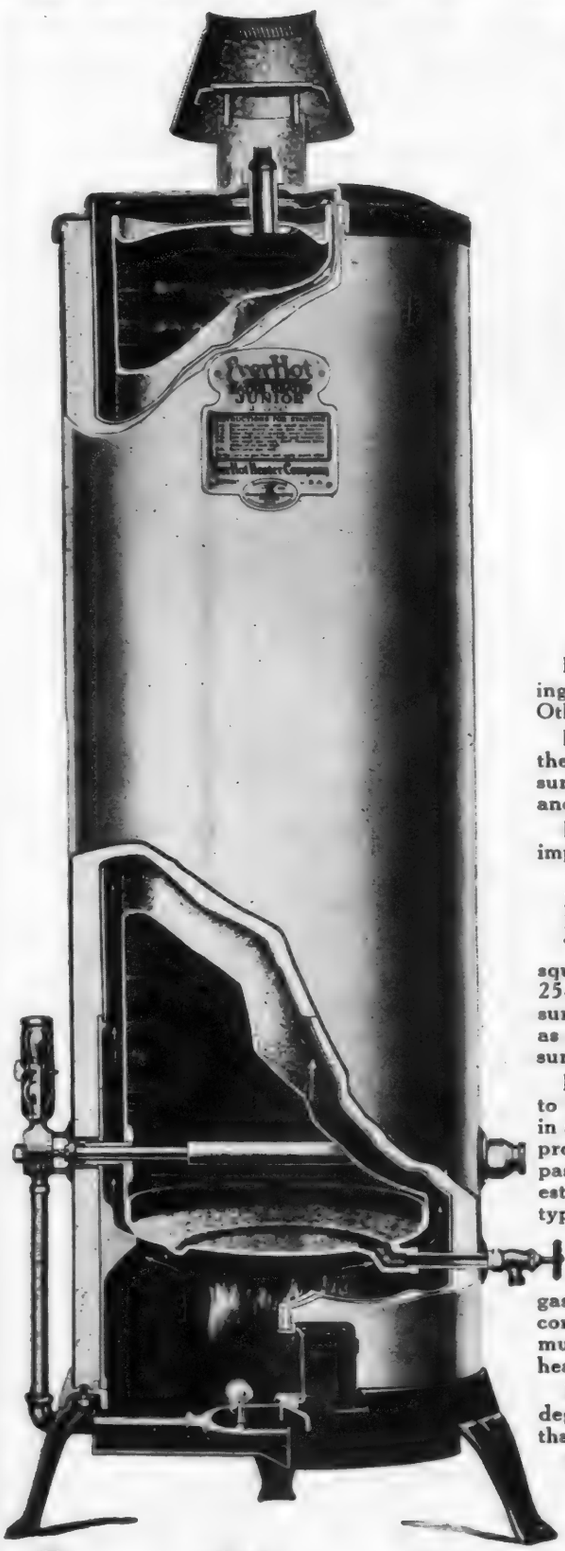
UTICA, N. Y.

BRANCH OFFICES

Boston	*Detroit	*Philadelphia
*Chicago	Grand Rapids	Pittsburgh
Cincinnati	Milwaukee	*St. Louis
Cleveland	*New York	*Utica

*Warehouse in connection

Some of the Features of the EverHot AUTOMATIC WATER HEATER



1—Heating Surface.
2—Burner.
3—Thermostat.
4—Absence of Condensation.
5—Freedom from Liming.
6—Freedom from trouble.

1—Heating Surface

In the EverHot, the entire outside of the boiler is used as heating surface. The EverHot was the first to use the principle. Others have followed and more will do so. The principle is correct.

Before the advent of the EverHot other manufacturers went to the expense of covering up the splendid expanse of prime heating surface afforded by the outside of the boiler itself and then added another expensive heating surface not nearly so good.

By using the storage tank as heating surface the following important results are accomplished.

1. Efficiency in operation.
2. Compactness.
3. Low price.

The Junior EverHot Heater has a heating surface of 1850 square inches—just about three times the surface afforded by a 25-foot copper coil heater—and just about equal to the heating surface of a 3-gallon instantaneous heater costing almost twice as much as the EverHot Junior. With this great spread of heating surface is it any wonder that the EverHot is so efficient?

In order to build a heater that is highly efficient, it is necessary to have a large proportion of heating surface to burner capacity, in addition to a long heat travel. As well as a long heat travel and proportionately large heating surface, the heated gases must be passed over the heating surface in such a manner that the greatest possible number of heat units will be absorbed. In all other types of heater the products of combustion have a comparatively free flow from the burner to the flue and naturally pass over the heating surface very quickly. With our long narrow flueway, properly stepped and scientifically proportioned, the hot gasses pass through the heater only fast enough to permit of complete combustion in the burner. As a result, we get maximum scrubbing action and almost complete absorption of the heat units available.

By using the storage tank as the heating element, we reach a degree of compactness, graceful design, efficiency and low cost that is not possible in any other construction.

Next issue, subject No. 2—"The Burner" will be treated.

Prices
Baby Grand $66 — Junior $99 — Senior $160

EverHot Heater Company

5215 WESSON AVENUE **DETROIT, MICHIGAN**

ROSS STEEL HEATING BOILERS

FUEL SAVERS

Novel design giving most effective heating surface arrangement with perfect circulation of water and long travel of fire.

LONG LIFE

In Ross Boilers is assured with lowest cost of maintenance because of the exclusive mechanical features and highest quality of workmanship and material.

Superiority Proved in Every Installation.

Approved by Leading Engineers.

Burns Coal Smokelessly.

Parts Simple and Standard.

The Perfect Oil Burning Boiler.

Electrically Welded to Comply with A.S.M.E. Code.

PATENTED

MADE BY

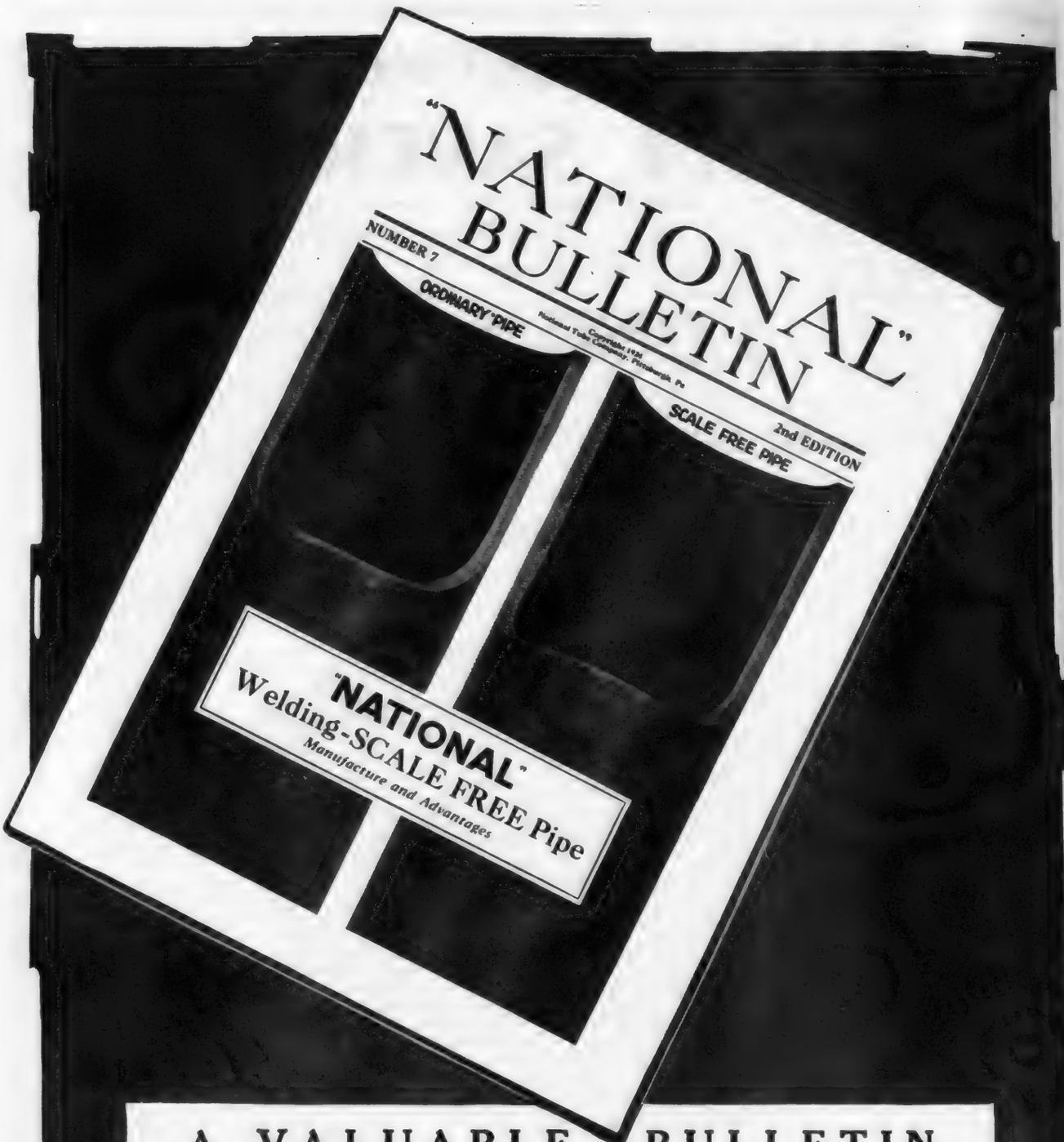
The Frost Manufacturing Co.

ESTABLISHED 1851 GALESBURG, ILL.

GENERAL AGENTS

ROSS BOILER COMPANY

112 WEST ADAMS STREET CHICAGO, ILL.



A VALUABLE BULLETIN

For those who Buy or Install Butt-weld Pipe for Plumbing and Heating Purposes

Explains how the former troublesome welding-scale or mill-scale is eliminated from this class of pipe—leaving both inside and outside surfaces clean and smooth. When this scale is removed, corrosion, especially in the form of pitting, is greatly reduced and longer life obtained in the pipe. Use the coupon for your copy of this Bulletin to get the complete story.

NATIONAL TUBE COMPANY General Sales Offices FRICK BUILDING **PITTSBURGH, PA.**

Please send Bulletin No. 7—"NATIONAL" Welding-SCALE FREE Pipe to

Name .....

Address .....

.....

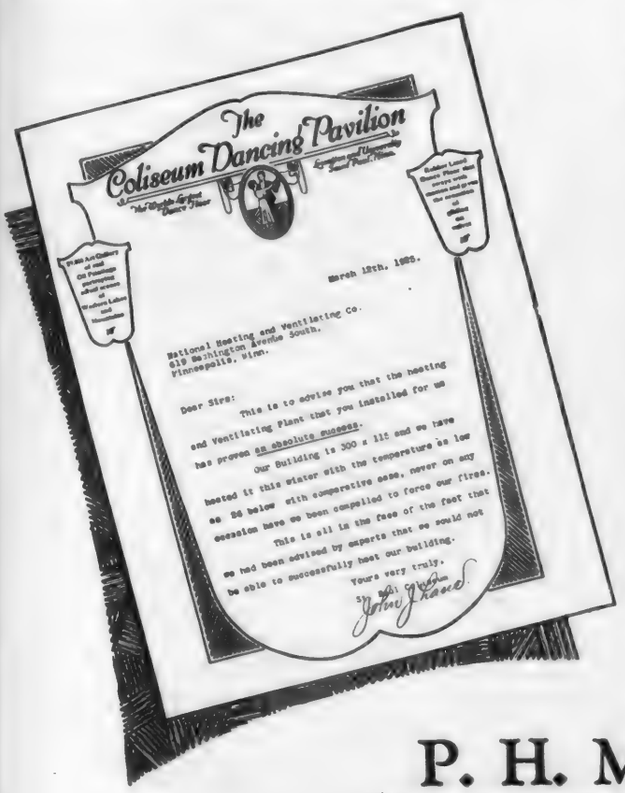
THE NATIONAL SYSTEM

AN ABSOLUTE SUCCESS

THE COLISEUM Dancing Pavilion at St. Paul, Minn., is 259 feet long by 112 feet wide with an eighteen foot ceiling. The heat loss is 1,770,000 B.T.U. per hour.

One No. 8 Sturtevant Blower supplies 22,000 C.F.M. The direct fired units are equipped with Lane oil burners.

Entire building heated efficiently and economically in coldest winter weather.


The Coliseum Dancing Pavilion

March 18th, 1920.

National Heating and Ventilating Co.
619 Washington Avenue South.
Minneapolis, Minn.

Dear Sirs:

This is to advise you that the heating and Ventilating Plant that you installed for us has proven an absolute success.

Our Building is 300 x 112 and we have heated it this winter with the temperature as low as 26 below with comparative ease, never on any occasion have we been compelled to force our fires.

This is all in the face of the fact that we had been advised by experts that we could not be able to successfully heat our building.

Yours very truly,

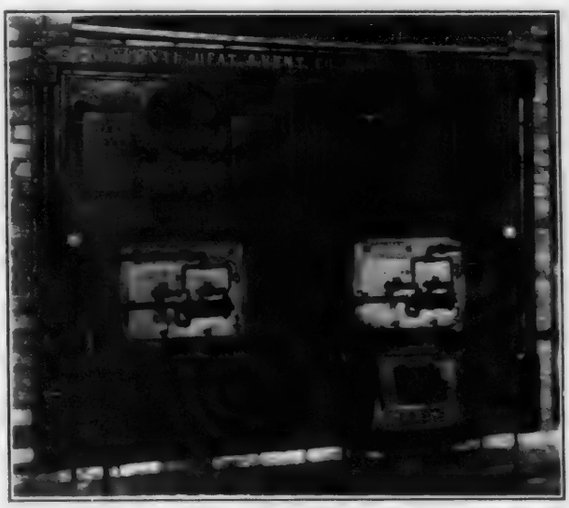
John J. Reed

WITHIN the past few years there has been a steady trend toward the more general use of direct fired units in all types of heating and ventilation.

The advantage and economy to be secured by the elimination of traps, valves, gauges, high pressures, and apparatus liable to break, freeze or explode is well established.

The direct fired units used in the National System are constructed exclusively of cast iron. They are massive and rugged and scientifically designed for fan blast systems of heating and ventilating.

Write us for interesting booklet about the National System.



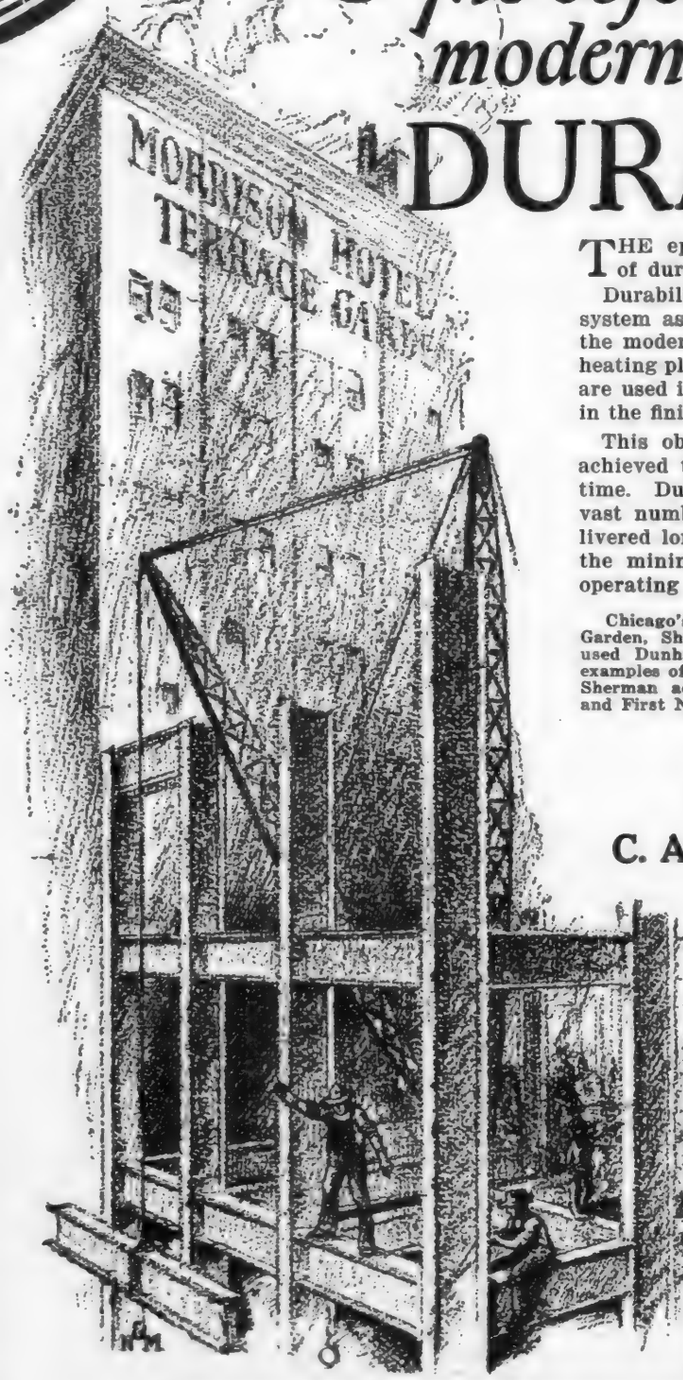
Two Oil Burning Direct Fired Units Heat 22,000 C.F.M. with Thermometer at 26 Below Zero. Installed by The National Heating and Ventilating Co., Minneapolis, Minn.

P. H. MAGIRL

FOUNDRY AND FURNACE WORKS

BLOOMINGTON, ILL.

The objective of the modern builder is DURABILITY



THE epic of the modern office building is a story of durability told in terms of steel and stone.

Durability is as vital in the office building heating system as it is in the structure which it warms. And the modern builder uses the same care in selecting the heating plant as he does in choosing the materials which are used in the foundations, the beams and girders, and in the finish of his building.

This objective of durability in the heating plant is achieved through but one infallible source—the test of time. Dunham Heating Service has met this test in a vast number of office and other buildings. It has delivered long-continued, wholly satisfactory service with the minimum of expense for repairs and with a low operating cost.

Chicago's nationally famous Morrison Hotel and Terrace Garden, Sherman Hotel and The First National Bank have all used Dunham for more than a decade and may be cited as examples of Dunham durability. The recently completed 24-story Sherman addition specified Dunham, as do both the Morrison and First National extensive additions now being erected.

Over sixty branch and local sales offices in the United States and Canada bring Dunham Heating Service as close to your office as your telephone. Consult your telephone directory for the address of our office in your city.

C. A. DUNHAM CO. 230 EAST OHIO ST., CHICAGO

Above—The Dunham Thermostatic Radiator Trap.

At the Left—The Dunham Packless Radiator Valve.

The DUNHAM REG. TRADE MARK HEATING SERVICE

Gas Heating is Desirable in the Very Large Home, too—

Fine interior furnishings and decorating are unblemished by soot or an oily film, as with other fuels.

No unsightly traces of dirty fuel deliveries are left on the drive ways and at window openings.

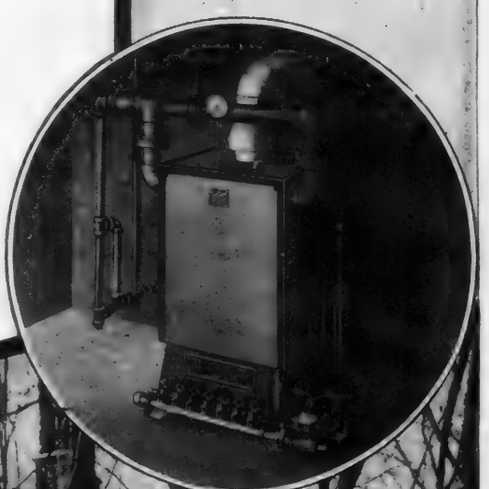
A new cleanliness is noticeable within the house and without.

And the heating plant in operation requires not even a glance for weeks at a time!

Is there any help or co-operation our engineers can give you?

THE BRYANT HEATER & MANUFACTURING CO.
954 East 72nd Street, Cleveland, Ohio
Branches in Principal Cities

BRYANT HEATING
***for* Hot Water** (Artificial Gas) **Steam *or* Vapor**



Residence in Ashland, Ohio
Architect: Mr. Packard, Columbus, O.
Heating Contractor: C. A. Kottmeier

Control at Each Radiator with Mouat System of Heating

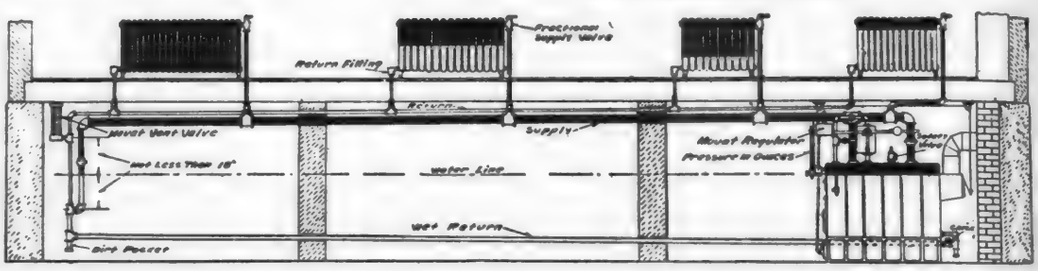
The primary object of the Mouat System is to permit a positive hand control of the heat at each radiator, making it possible to regulate the temperature in each room.

This is accomplished by partially opening or closing the radiator supply valves, allowing only a portion of any radiator to become heated. Any radiator may be turned on fully or closed off completely.

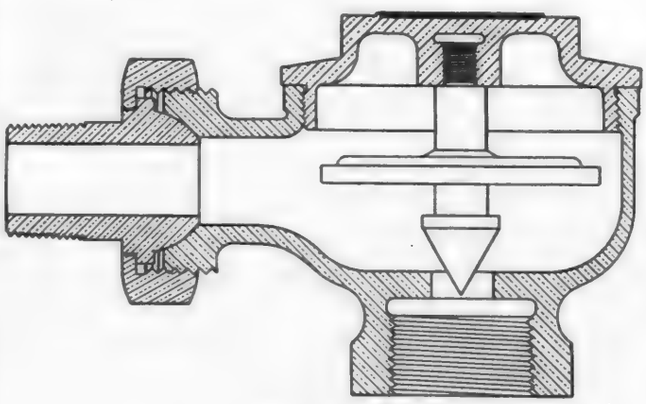
Shaded portions of the radiators in the diagram below show how the heat in the radiators can be graduated or controlled as desired.

Let us send full details

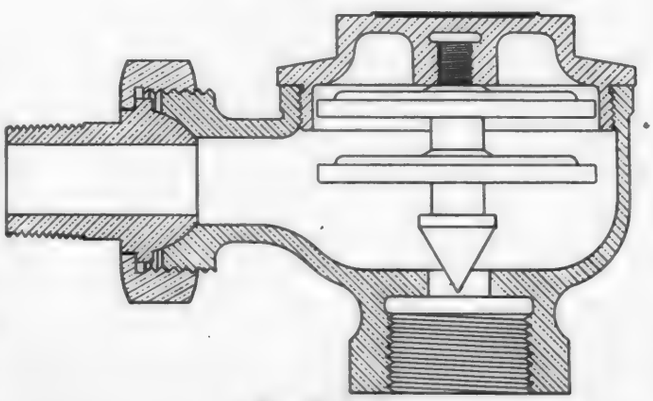
MOUAT VAPOR HEATING COMPANY
CLEVELAND, OHIO



Showing how the Heat can be Graduated or Controlled



No. 1 TRAP



No. 2 TRAP

THE NO. 1 and NO. 2 THERMOFLEX RADIATOR TRAPS

The No. 1 Trap has one diaphragm.

The No. 2 Trap has two *separate* and *distinct* diaphragms in one body, each being separately filled and sealed either one having sufficient power to close independently of the other.

Diaphragm has no central hole, the inherent weakness heretofore. The outer edge is double turned and cannot break.

Write for Catalog and Prices

W.D.CASHIN COMPANY
35 HARTFORD ST. BOSTON

The tenant "fires" but twice a year —the owner twice a day

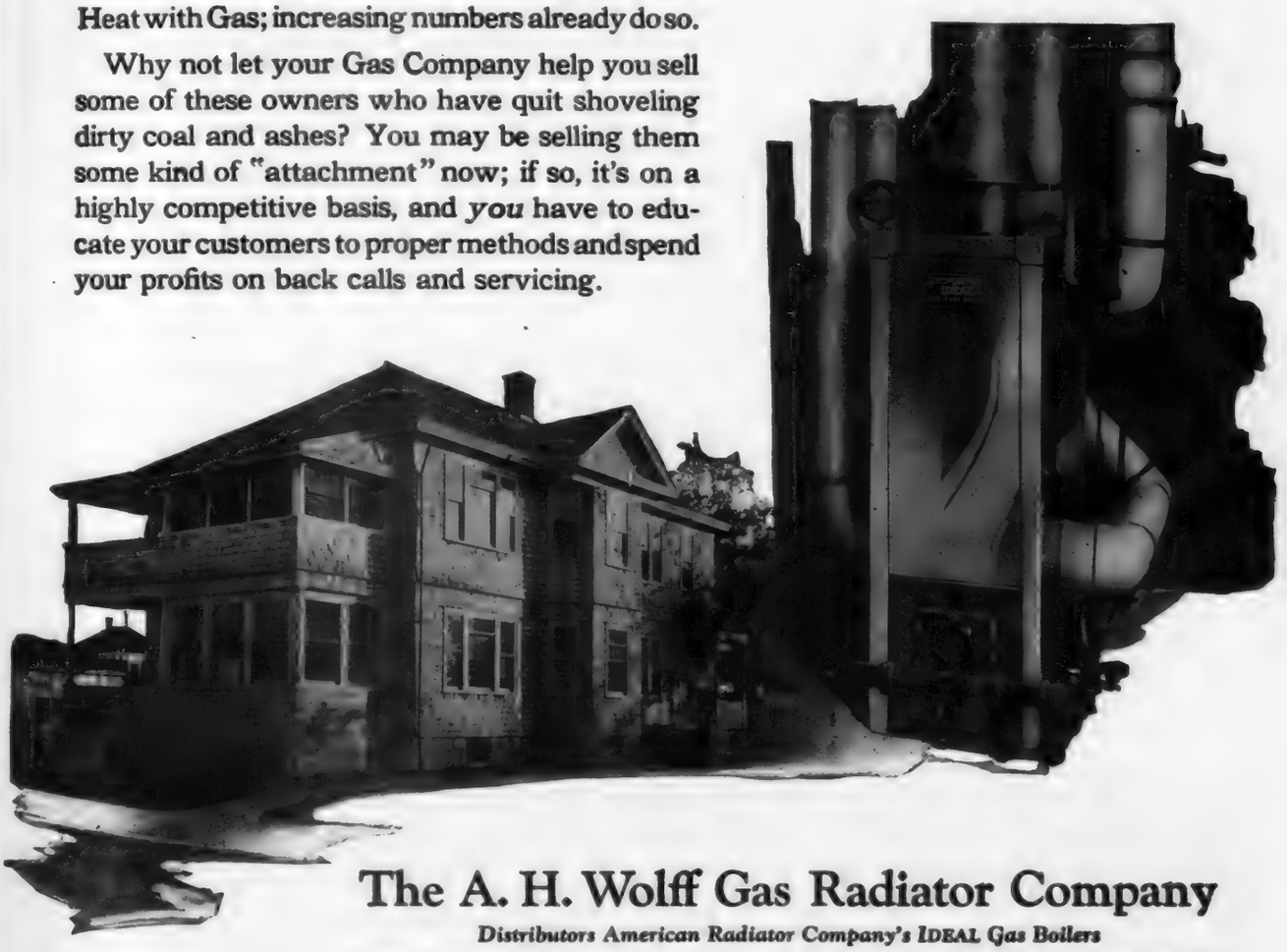
THE LOWER APARTMENT of this New England "duplex," occupied by a tenant, is warmed by an IDEAL Gas Boiler, pictured below. Outside of occasional inspections, this unique Boiler, with its automatic control, requires but two "firings" a year—once in the fall to light the pilot light and again in the spring to turn it off!

In the upper apartment, the owner resides. Its warmth is earned by the sweat of the owner's brow, for his coke-burning boiler needs firing at least twice a day, even in mild winter weather!

More and more owners are daily turning to non-solid fuels for heating. Eventually they will Heat with Gas; increasing numbers already do so.

Why not let your Gas Company help you sell some of these owners who have quit shoveling dirty coal and ashes? You may be selling them some kind of "attachment" now; if so, it's on a highly competitive basis, and *you* have to educate your customers to proper methods and spend your profits on back calls and servicing.

Your local Gas Company can show you how to *keep* the profits you earn. They're good people to know.



The A. H. Wolff Gas Radiator Company

Distributors American Radiator Company's IDEAL Gas Boilers

376 Lafayette Street *Dept. G 40* New York, N.Y.

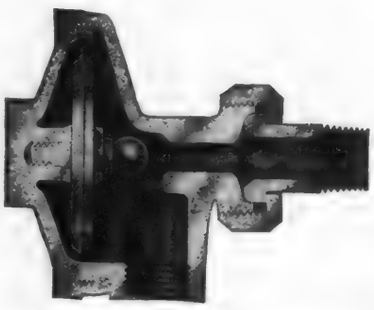
TEMPLE B'NAI ABRAHAM, NEWARK, N. J.
Nathan Myers, Architect Elias Berla, Heating Contractor

ILLINOIS HEATING SYSTEM

Selected for this Architectural Gem

The same taste and judgment of values apparent in the architectural features of this monumental Temple, were also evidenced in the selection of the mechanical equipment installed so that the completed structure is harmonious in every detail.

Illinois Heating System was selected to insure positive and satisfactory heating of this Temple.



ILLINOIS THERMO RADIATOR TRAP

The Original Vertical Trap.
Dirt Proof—Positive Action—
Long Life.

SPECIFY ILLINOIS HEATING SYSTEMS

Our Engineering Department will cooperate with installation details, and our guarantee covers satisfactory operation.

THE PRODUCT OF 25 YEARS OF SUCCESS

1900—1925

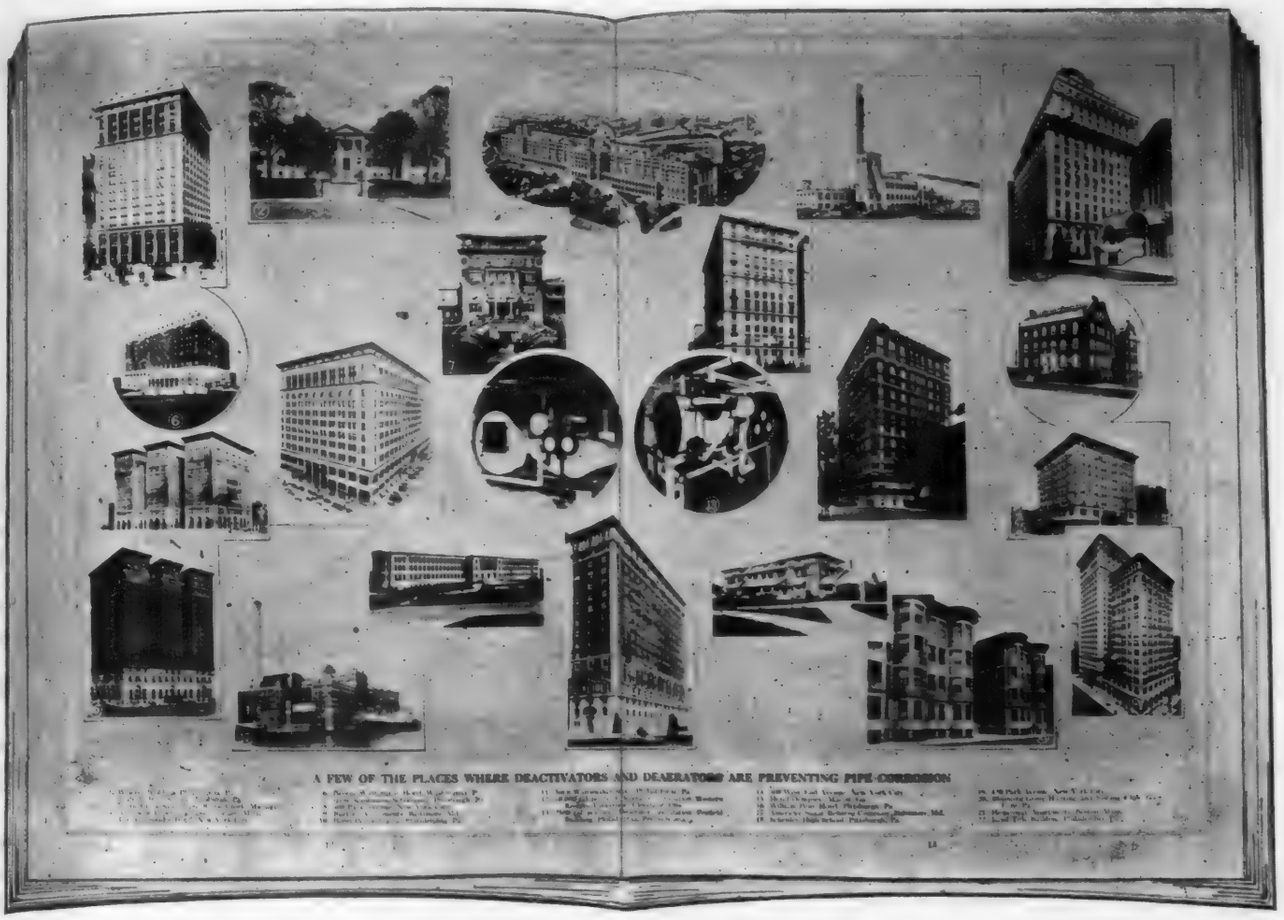
Write for Bulletin No. 25

REPRESENTATIVES IN 40 CITIES OF U.S.A.

ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President INCORPORATED 1900

CHICAGO



No Corrosion Problems Here

The illustration above reproduces the center spread from our bulletin entitled, "Water—But No Corrosion." It shows a few of the buildings and institutions which have permanently protected their water lines by means of an Elliott Deaerator or Deactivator installation.

By removing the dissolved oxygen and other gases from the water, these units definitely overcome corrosion in piping. They protect the piping investment and eliminate unpleasant and expensive experiences with rusty water, stained fixtures, bursting pipe lines, and their after effects.

We'll Send the Bulletin and Particulars Upon Request

ELLIOTT COMPANY

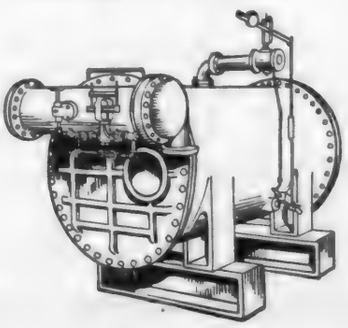
Pittsburgh, Pa.

General Sales Offices: Jeannette, Pa.

District Sales and Service Offices: Atlanta, Baltimore, Boston, Cincinnati, Cleveland, Chicago, Detroit, Kansas City, New York City, Philadelphia, Pittsburgh and St. Louis

N-834

De-oxygen-ating Deactivators



Apparatus Deaerators

The "Milvaco" Line

Standard Valves

Radiator Valves—
All Types
Union Elbows
Globe Valves
Gate Valves
Angle Valves
Compression Stops
and Wastes
Compression Stops
Needle Valves
Cross Valves
Brass Unions
Throttle Valves
Key Air Valves
Expansion Tank Gauges

MILVACO
MILWAUKEE
VALVE
CO.

Dole

"MILVACO"
Packless Radiator Valve

—always manufactured by us and, until recently, sold through The Dole Valve Company of Chicago, this nationally known packless radiator valve will henceforth be marketed through the sales organization of the Milwaukee Valve Company, Milwaukee, Wis.

The popular acceptance and universal use over a period of years of the Dole "Milvaco" Packless Radiator Valve testifies to its unfailing efficiency.

It is our pleasure to announce to the trade the addition of this accepted heating specialty.

MILWAUKEE VALVE CO.

"MILVACO" Thermostatic Trap

Thousands of successful installations throughout the United States testify to the adaptability and efficiency of this high grade product.

"Milvaco" Thermostatic Traps are constructed of the highest grade materials.

They will pass all water of condensation and air from a vacuum or vapor system, will positively prevent passage of steam, are noiseless, self-cleaning and durable.

Established in 1901, the Milwaukee Valve Company manufacture complete heating systems, heating specialties and high grade brass valves.

—serving for twenty-four years the plumbing and heating requirements of the United States and Canada.

The
"Milvaco" Line

Heating Specialties

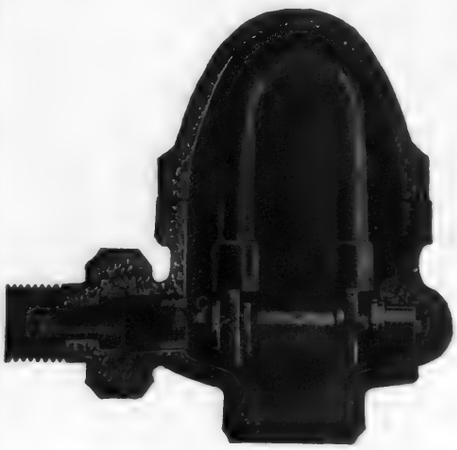
Packless Radiator Valves—
All Types
Drip Traps
Direct Return Traps
Air Line Valves
Thermostatic Traps
Air Eliminators
Quick Vents

Underwriters Approved Valves

Gate Valves
Angle Valves
Globe Valves
Throttle Valves

MILVACO
MILWAUKEE VALVE CO.

MILWAUKEE, WISCONSIN



The Perfect Automatic Valve for Vacuum or Vapor Heating

"VENTO" Advantages

System starts with valve wide open, assuring circulation almost the instant steam is turned on.

Control of valve opening from two to eight times larger than other makes of valves.

Size of valve opening reduces danger of fouling with scale or other foreign matter.

Closes absolutely tight against steam. No necessity for use of spray water at pump.

Cannot stick or gum from foreign matter, and operation is absolutely noiseless.

The "Vento" Automatic Valve represents a steady improvement in the Haines line of steam traps and offers the highest degree of steam trap efficiency.

There has been no change in the old reliable principle that has placed Haines Automatic Valve in a class by itself. The operating power is identical—the only difference being in the general construction.

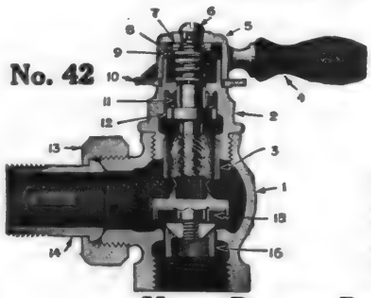
Special features are: Horizontal mounting of valve mechanism—long range of movement—positive action—quick opening and closing.

Send for booklet

WILLIAM S. HAINES & CO.
12th & Buttonwood Streets
PHILADELPHIA, - - PA.

VENTO

McALEAR SPECIALTIES FOR VAPOR HEATING SYSTEM



No. 42

Packless Radiator Valves

Quick-opening, nickel-plated brass body. Fig. 38, angle pattern, wood wheel handle; Fig. 42, angle pattern, graduating type, lever handle.

Vapor Damper Regulators

No. 58

All metal, tapped for 1-inch steam pipe connection. Shipped complete with lever and two weights, S hooks, 2 ceiling pulleys and 12 feet of No. 10 plumbers' chain.

No. 56 for 0 to 3 pounds pressure, constructed with bellows of 10-inch flexible walls. No. 58 for 1 to 15 pounds pressure, constructed with bellows of 6-inch flexible walls.

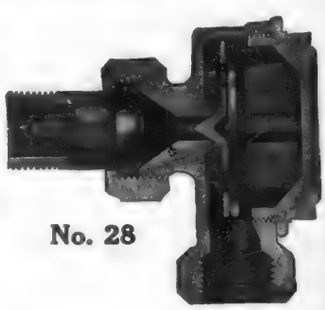
Combination Float and Thermostatic Ball Check Valves

For venting supply and return mains of heating systems. These air valves close tight against water and steam, and by use of the check prevent the atmospheric pressure from entering the discharge opening.

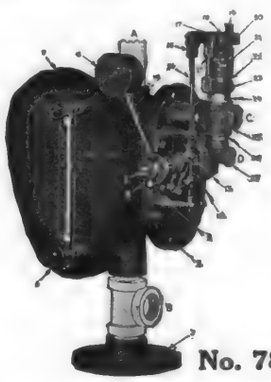
No. 15

Radiator Traps

Discharge air and water in large quantities. Close tight against steam. Noiseless in operation. Nos. 28 and 28-A of steam metal, furnished N. P. unless otherwise specified. Nos. 28-A and 29-A have right and left-hand discharge openings. Nos. 29, 29-A, 33, 34 and 36 have iron bodies and brass caps, furnished plain unless otherwise specified.



No. 28



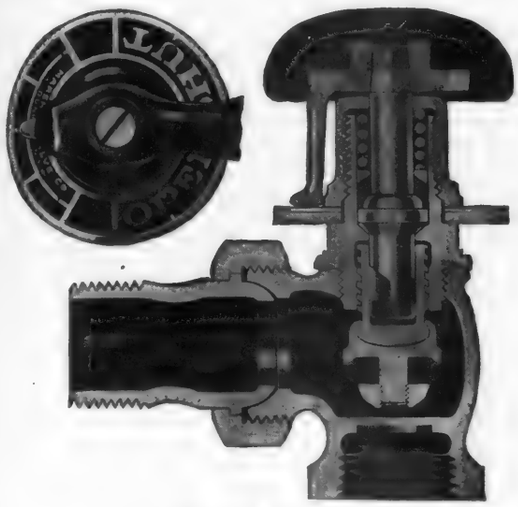
No. 781

Air Eliminator and Return Traps

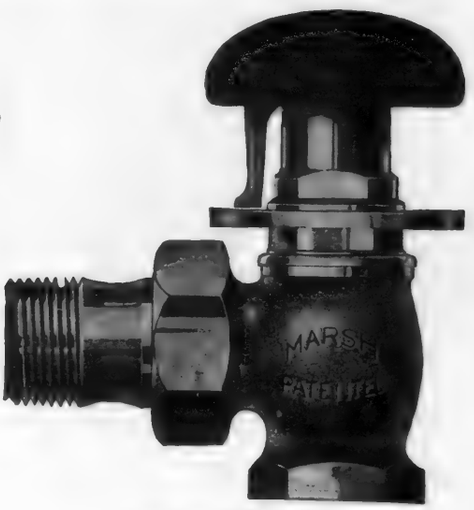
For automatically returning the water of condensation direct to boiler and discharging air. Minimum distance between water line of boiler and bottom of trap should be 18 inches. "A"—inlet to trap; "B"—discharge to boiler; "C"—steam connection to boiler; "D"—air vent.

THE McALEAR MFG. CO.
1901-7 S. Western Ave.
CHICAGO, ILL.

Something Entirely New in Water Heat Regulation



Packless Feature



Graduated Fig. 139

We have made a special study of hot water heat regulation and control and are pioneers in the matter of individual radiator control, through a graduated valve, employing the same principle as with steam. If you can modulate, graduate, or regulate individual radiator vapor or vacuum steam heat through a valve (and you can), then why not by the same principle regulate water heat, and, for that matter more consistently than steam, as with water you have something to regulate, while with steam, to allow fire to drop below a given point, you have nothing.

For Sleeping Rooms, heat regulation with the **Marsh Graduated** water valves may be controlled with the **same ease of operation and certainty of results** as is possible with a Modulated valve on a steam system, and **at a much less cost than for a vapor or vacuum system installation.**

Further, water circulation for each radiator, graduating for same **or balancing of system,** can be increased from nothing to full pipe capacity and **held or locked at any intermediate point,** if desired, by simply turning dial so that stop on same will register against indicator or pointer and locking dial in this position, preventing further opening of valve or turning of wheel or lever handle to the left.

These valves cost but little more than our regular water valves and **much less than steam modulated valves.**

MARSH VALVE COMPANY

DUNKIRK **NEW YORK**

Exclusive Sales Distributors

Appleton & Liptrott, Inc.
1480 Broadway, New York

Edward T. Hetherington,
1718 Sansom St., Philadelphia, Pa.

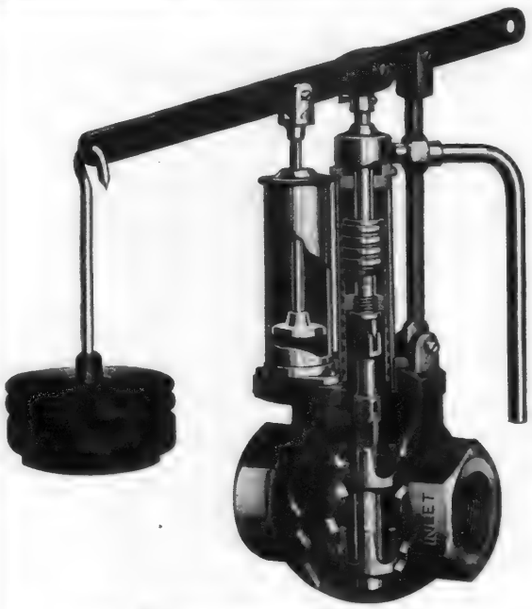
United States Radiator Corp'n
General Offices: Detroit, Mich.

All territory east of west lines of Michigan and Ohio and north of Virginia, except New York and Philadelphia.

John W. Mabbs,
431 So. Dearborn St., Chicago, Ill.

Jas. P. Marsh & Company
118 So. Clinton St., Chicago, Ill.

All territory south of Ohio River and west of Michigan and Ohio, except Cook County. "Chicago, Illinois."



No. 1 Pressure Regulator—Piston Type
Made in sizes ⅜ to 14 in. inclusive—Std. and Ex. Hvy.
Sizes 1½ in. and under made with bronze bodies—screwed ends only.
Sizes 2 to 6 in. inclusive made with iron bodies—screwed or flanged ends.
Sizes 7 in. and above made with iron bodies—flanged ends only.

KLIPFEL
PRESSURE REGULATORS

Automatically reduce any initial steam, air or water pressure to any desired reduced pressure above 2 lbs.

Maintain reduced pressure constantly regardless of fluctuations in boiler pressure, or changes in the demand for steam.

Simple, rugged and direct acting. As low pressure builds-up and exerts pressure under piston, a balance is formed between low pressure and weighting, which in turn regulates the inner valve opening.

Visible in action. Lever may be used to open, close or test by hand. Position of inner valve may be easily judged by looking at the lever.

Bronze cylinder, multiple grooved piston and balanced plunger type bronze inner valve. All working parts removable while valve body remains in the pipe line.

No troublesome springs, toggles, packing boxes or pilot valves. Dashpot included, which insures steady service pressure and overcomes any tendency of valve to chatter or vibrate.

Guaranteed to closely regulate at maximum steam loads, as the capacity—size for size—is equal to or greater than that of any competing pressure regulator.

We Invite Correspondence.

KLIPFEL MFG. CO., 2641-59 W. Harrison St. CHICAGO, ILL.

Manufacturers of a Complete Line of Steam Specialties including Expanded Outlet Pressure Regulators (Both Piston and Diaphragm Types)—Float Valves—Pump Governors—Back Pressure Valves—Relief Valves—Grease Traps—Steam Traps and many other Specialties.
Sold by Leading Jobbers in all Principal Cities—Write for Catalog No. 20.

Here are SEVEN *Outstanding Constructional Features of the* SCOTT SWING CHECK VALVE

Scott Swing Check Valve

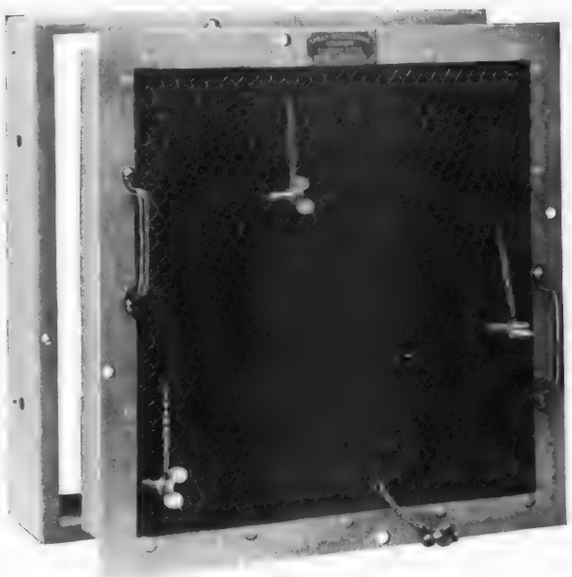
1. Made of best grade bronze.
2. Extra heavy body.
3. Substantial hex on cap gives a good grip for wrench in case valve is to be taken apart.
4. Hexes are MILLED to standard sizes, making them readily interchangeable.
5. Disc revolves and is self adjustable. It closes at an angle of 45° which makes its action positive and opening is easier under slight pressure.
6. When regrinding plug, which is easily accessible, is removed, there is plenty of room to insert tool to revolve the disc on the seat.
7. The bridge wall is very heavy and lends strength to entire body of valve.

Scott Valve Manufacturing Company
3962 McKinley Avenue Detroit, Michigan

SCOTT SINCE 1886 VALVES
SIGN OF VALUE
"MAXIMUM SERVICE PER DOLLAR"

SPRACO
AIR FILTERS

No System of Ventilation is complete without a **Spraco Air Filter,** which is your assurance of **Absolutely Clean Air.**



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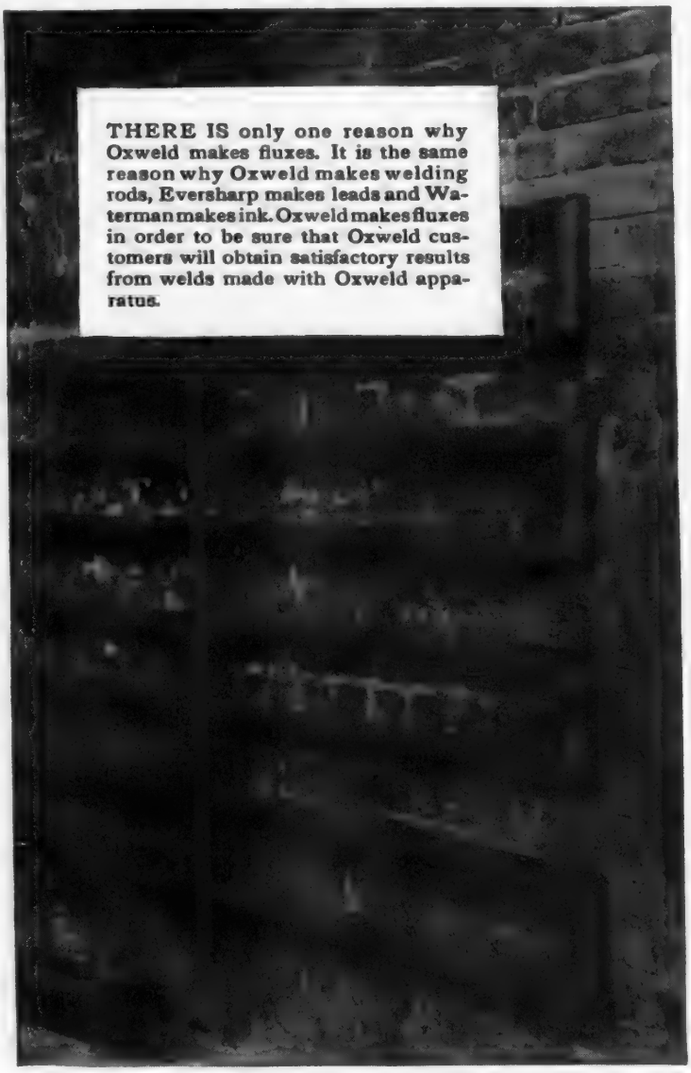
THERE IS only one reason why Oxweld makes fluxes. It is the same reason why Oxweld makes welding rods, Eversharp makes leads and Waterman makes ink. Oxweld makes fluxes in order to be sure that Oxweld customers will obtain satisfactory results from welds made with Oxweld apparatus.

FLUXES are used in welding to remove oxides. There are other primary reasons for their use, but this is the most important.

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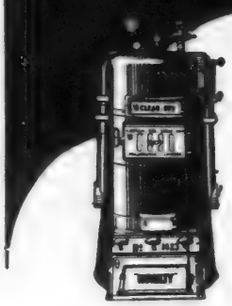

YOU all know the various and uncertain methods of boiler selection which have prevailed for years, due to the continuous raising of ratings. Even the experts have been confused.

The situation had grown so bad that last year the cast iron boiler manufacturers were called together by one of the engineering societies and asked to compose their differences and agree upon some uniform method of boiler rating.

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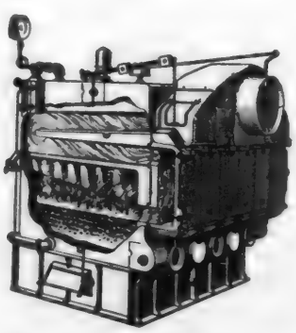

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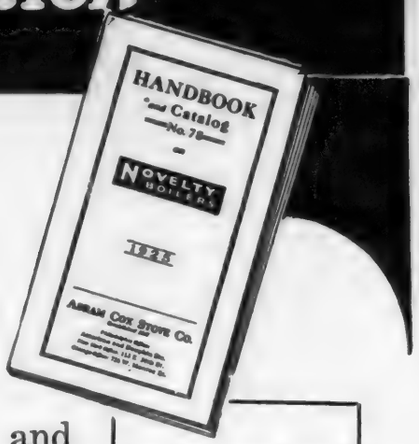

thing has been possible, and it is made possible now only by scrapping all old methods of selection and basing this process on an entirely new principle.

In the Novelty Boiler Selection Plan you select a boiler by the dimensions of the flue, and automatically you get that proper balance of boiler and flue which insures the most satisfactory results from a steam or hot water heating system. Complete tables show how the use of a Novelty Boiler of a given capacity with a flue of a given size, brings perfect co-ordination throughout the entire plant.

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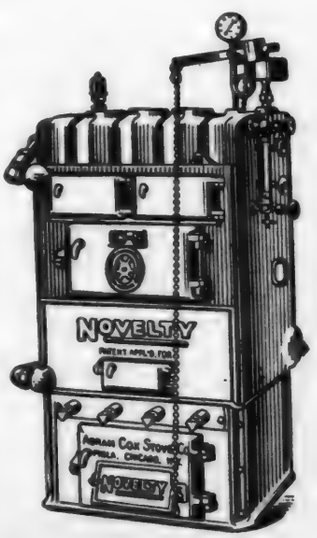

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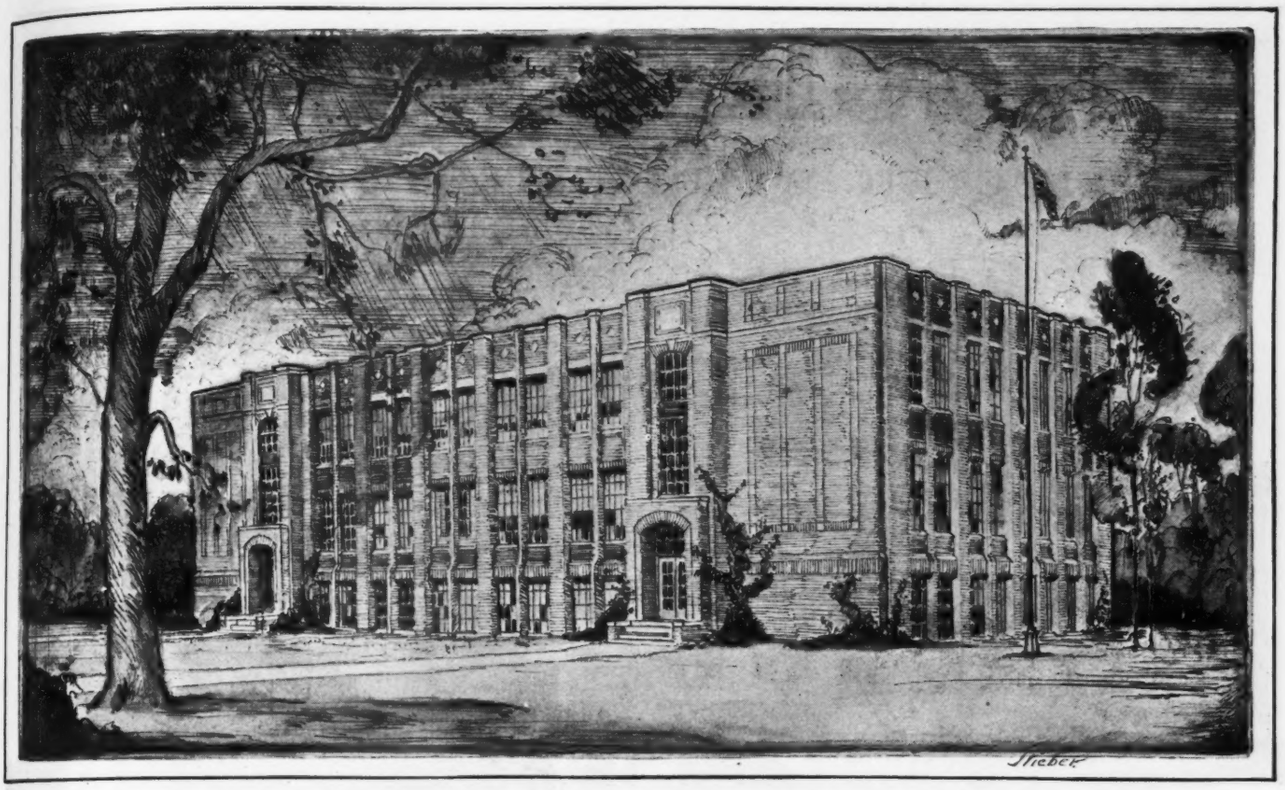

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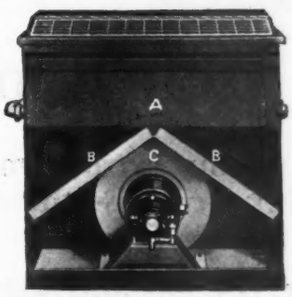

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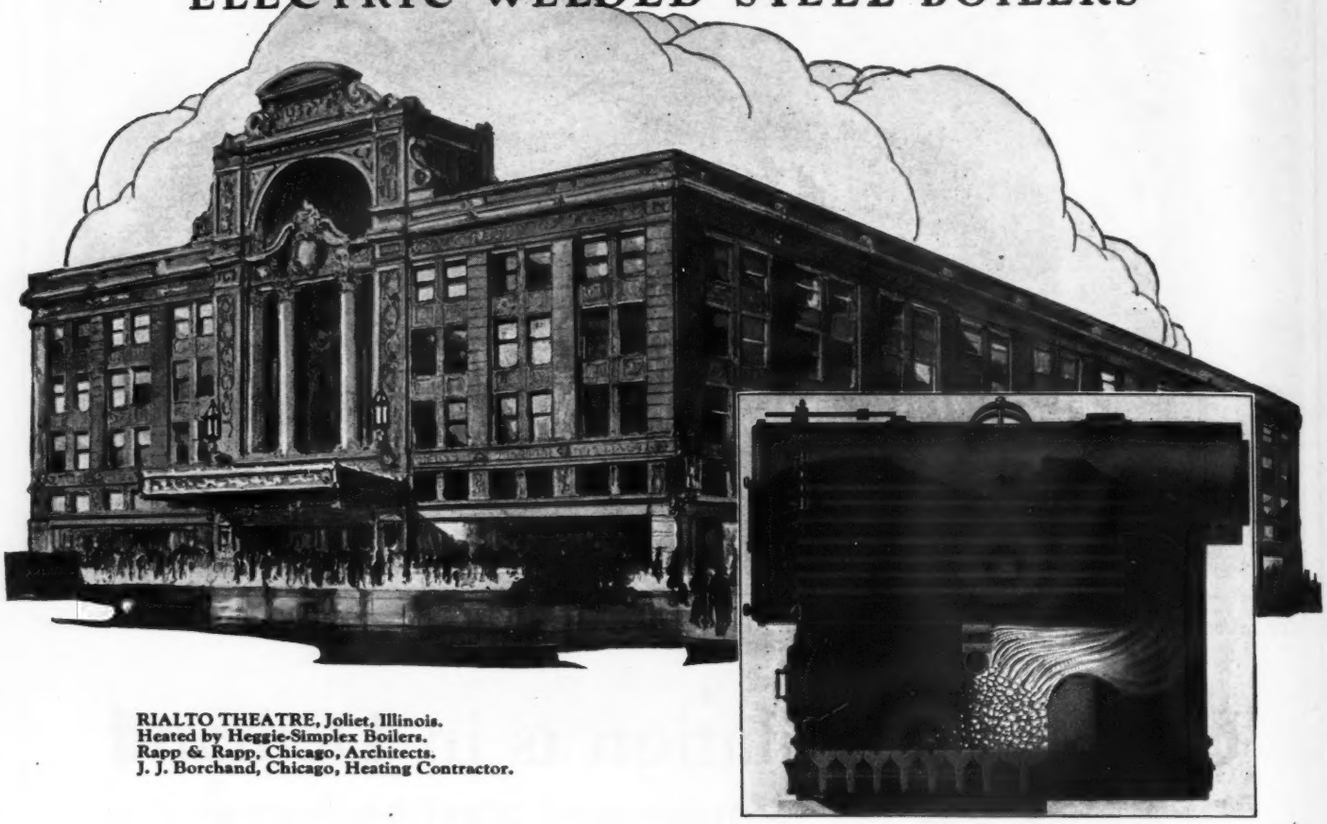

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Rapp & Rapp, Chicago, Architects.
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The Heating and Ventilating Magazine

VOL. XXII Reg. U. S. Pat. Off. Reg. Canadian Pat. and Copyr't. Off. No. 6

Contents for June, 1925

The Cooling of Theatres and Public Buildings.....*H. J. Macintire* 49
Mechanical Refrigeration Design, with Solution of Problem for Installing Cooling Plant in 3000-Seat Theatre.

Known and Unknown Factors in Heating Work.....*By William Sommer* 53

What Happens When We Burn Oil.....*James L. Breese, Jr.* 54
Importance of Oil Flame Analysis and Significance of Blue and Yellow Flames.

Home-Study Course in Gravity Steam and Water Heating..... 57
Lesson No. 8.

Progress of House Heating by Gas in Chicago.....*Glenn C. Carnahan* 63
1. Can House Heating by Gas be Developed into a Big Business?

Back to First Principles.....*T. W. Reynolds* 65

Stabilized Conditions Reported in District Heating Field..... 69
Possibility of Lower Fuel Costs, Due to Improved Labor-Saving, Coal-Mining Machinery, Bright Spot at Association's Annual Convention.

Wisconsin's Revised Heating and Ventilation Code..... 74
Full Text of the Latest State Law Covering Standards for Heating and Ventilation of Public Buildings and Places of Employment.

Relation of the Architect to the Sub-Contractor..... 75

Manufacture of Heating Products Jumps 75% in Two Years..... 76

Suppose That Coal Was Unknown..... 77

The Weather for April, 1925..... 78
New York, Boston, Pittsburgh, Chicago and St. Louis.

Oil Burner Manufacturer Holds Record-Breaking Sales Convention..... 80

All Kansas City Schools Burn Oil..... 82

New Regulations for Construction and Use of Oil-Burning Equipment..... 83

American Society of Heating and Ventilating Engineers..... 89
New York Chapter Closes Season with Dinner. Illinois Chapter's May Outing. Western New York Chapter.

Correspondence..... 90
Determining Air Capacities of Vacuum Pumps. The Apprenticeship Situation in the Steam-Fitting Industry.

An Opportunity for Heating Engineers to Co-operate with Architects..... 90

Chimneys and Flues in Building Codes..... 90

Oil Burners Newly Listed by Underwriters..... 91

Legal Decisions..... 92
Heating Service May or May Not be a Public Service—Right to Discontinue Service. Patent for Vacuum Steam Heating System Held Valid But Not Infringed.

The State of Business.....*L. W. Alwyn-Schmidt* 93
Spring Business Below Expectations.

Standard Heating and Ventilating Data Sheets.....**Insert**
4-G—Temperature-Time Conversion to "Degree-Days"—Definition and Applications.
4-H—Temperature-Time Conversion to "Degree-Days"—Table Developing "d.-d." for Various Cities.
4-I—Temperature-Time Conversion to "Degree-Days"—Annual Coal and Oil Fuel Requirements at Different Boiler Efficiencies.
4-J—Temperature-Time Conversion to "Degree-Days"—Degree-Day Variations in Different Years, and Corresponding Variation in Annual B.T.U. Required.

Engineers' Specification Index, Page 146

Advertisers' Index, Page 154

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